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The Journal of HEREDITY

A monthly publication devoted to Plant Breeding Animal Breeding and Eugenics

THE PIONEER BLUEBERRY
A Triumph of Fruit Breeding

Polled and Horned Cattle **Evolution of the Human Mind**

JULY, 1927 Vol. 18, No. 7

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The

Journal of Heredity

VOL. XVIII, No. 7 JULY, 1927

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The JOURNAL OF HEREDITY is published monthly by the

AMERICAN GENETIC ASSOCIATION

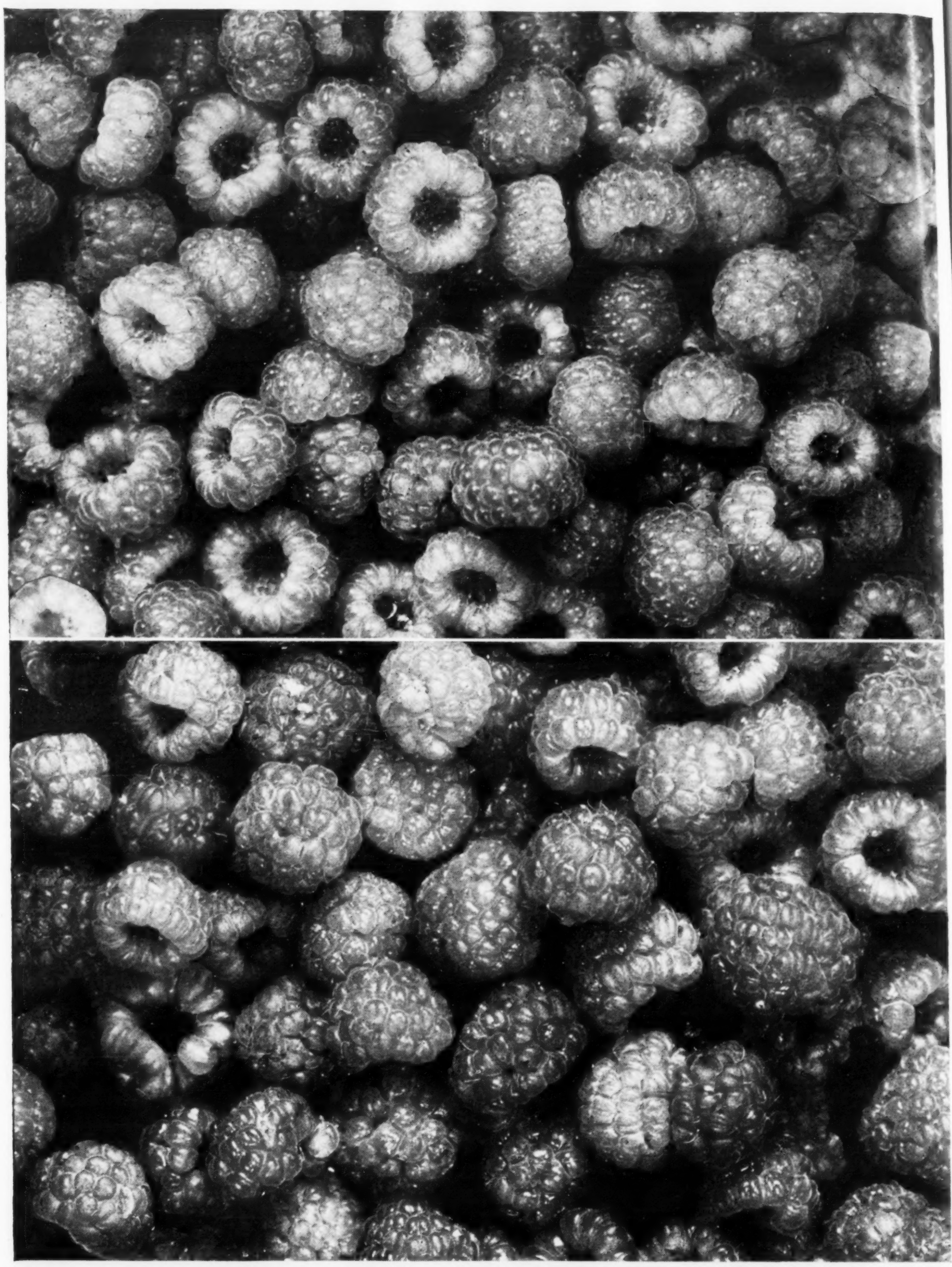
At 1918-32 Harford Avenue, Baltimore, Md., and Victor Building, Washington, D. C.

Address communications regarding editorial matters and the business management of the Association to Room 306, Victor Building, Washington, D. C.

Entered as second class matter February 24, 1923, at the postoffice at Baltimore, Maryland. Acceptance for mailing at the special rate of postage provided for in Section 1103, Act of October 3, 1917, authorized December 20, 1918. **Contents copyrighted 1927 by the American Genetic Association. Reproduction of articles or parts of articles permitted only upon request, for a proper purpose, and provided due credit is given to the author and to the JOURNAL OF HEREDITY, Washington, D. C.**

Date of Issue of this number, October 10, 1927

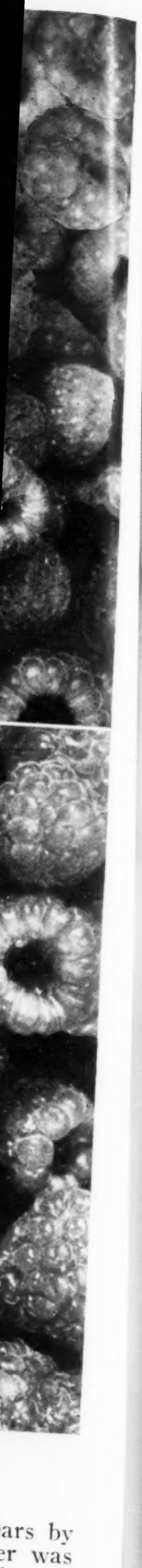
$3.50 *a Year;* 35c *the Copy, for current numbers*



OUTSTANDING RASPBERRY VARIETIES

Frontispiece

Two raspberry varieties of the greatest promise have been originated in recent years by the experiment stations, the Van Fleet (above) and the Latham (below). The former was produced by Dr. Walter Van Fleet by crossing *Rubus innominatus* with the Cuthbert red raspberry. It has recently been introduced by the U. S. Department of Agriculture, and promises to fill a long-felt want in furnishing a productive and delicious raspberry suited to conditions in the southern states. The Latham was originated from a cross made in 1908 at the fruit-breeding farm of the Minnesota Experiment Station. It was introduced in 1914, and has already made a place for itself in northern and eastern states. "In 1926 the income derived by Minnesota growers [from this raspberry] was more than four times the total amount expended by the state on the fruit breeding farm since it was established in 1908."



PROGRESS IN FRUIT BREEDING

Extent and Results of the Fruit Breeding Work of Experiment Stations and of the United States Department of Agriculture

GEORGE M. DARROW

THE extent and significance of the fruit breeding work under way at experiment stations is not generally realized, nor are many people acquainted with the results already obtained. It is not yet possible to present a picture as vivid as that made by the Iowa Experiment Station with their new oat varieties, of which over a million acres are grown annually in Iowa, a state formerly thought not to be adapted for the growing of this cereal. Nevertheless, new fruits from experiment stations have rapidly become important and there always will be a very wide appeal in the development and introduction of fruits.

Though the problems are innumerable, to the writer six possible accomplishments in the breeding of fruits seem especially desirable: the production of (1) apple varieties of the McIntosh type which will extend the season of apples of that quality the year through and to all sections of the country; (2) an apple variety which will start bearing the year after planting; (3) blight-resistant pears of high quality and adapted to that part of the country where desirable sorts cannot now be grown because of the pear blight; (4) raspberries adapted to the South; (5) strawberries at least as good in quality as the Marshall and which are adapted to all regions of the country and available throughout the year; (6) sweet cherries readily grown wherever cherries are hardy. Other ideals will doubtless appeal to other workers just as strongly.

Considerable progress has been made on each of the six problems listed. Several stations have introduced McIntosh crosses which greatly extend the season of apples of the most superb aroma, of a flesh so tender that very young children can eat them without harm, and of a beauty which rightly belongs to the rose family. The South Dakota Station has introduced an apple, the Anoka, which has been reported as bearing when very young, often the year after planting. The Iowa Station has introduced the Patten pear which is blight-resistant. The United States Department of Agriculture has introduced the Van Fleet raspberry, adapted to the southeastern part of our country; strawberry varieties of Marshall quality and a wide adaptation have yet to be introduced, though the Rockhill, from a private breeder, furnishes an everbearing sort of that type, and promising selections of the United States Department of Agriculture are being widely tested. Finally, selections of *Prunus tomentosa,* now being propagated by the United States Department of Agriculture, offer bush cherries which should furnish for home use a delicious fruit for eating out of hand, for jelly, pies, etc., even though they do not fill the place of the sweet cherry.*

Certain characteristics of fruits as contrasted with cereals make the replacement of old varieties relatively slow. With the exception of the strawberry in certain sections, fruits occupy the land for a period of years. Many varieties of fruits do not yield paying crops until the trees are nearly ten years old. Moreover, commercial orchards generally pay better when they consist of but few varieties. To avoid too many varieties in a single orchard

**Prunus tomentosa* was described and illustrated in the April, 1924, *Journal of Heredity,* Volume 15, No. 4.

even new plantings will, in many cases, consist largely of the old sorts. For these reasons growers cannot afford to change over young or bearing orchards to a new variety unless it has already proven remarkable in some respect. Even when the new forms represent a greater improvement than in the case of the Iowa oats, they will usually replace the standard varieties but slowly. The most rapid and extensive use of new sorts will occur in regions where satisfactory varieties are limited or lacking, as, for example, raspberries in the South or plums in South Dakota and adjacent sections.

Varieties That Have Attained Commercial Importance

Of the hundreds of new fruit varieties introduced by experiment stations several have already attained an outstanding commercial position. Among the most important are the plum varieties, Sapa, Opata, Waneta and the others introduced by the South Dakota Experiment Station, which are grown by the million in the upper Mississippi Valley. These furnish hardy fruits in a great territory where formerly none could be grown. The Sapa and Opata approach an ideal in certain characteristics—in bearing freely and in beginning to bear only a year or two after planting.

The blueberry breeding work of the U. S. Department of Agriculture has been the foundation of a commercial blueberry industry in New Jersey.

The outstanding new raspberry variety of the northern United States is the Latham, introduced by the Minnesota Experiment Station, and hardy there and quite widely grown in the surrounding states. It is apparently one of the best commercial varieties in New England, New York and Maryland. As a canned fruit it also appears promising. Already four-fifths of the acreage in Minnesota is planted to this variety.

Apple crosses with McIntosh originated by the Canadian, New York and other stations are gradually becoming commercially important. The Early McIntosh, introduced by the New York State Experiment Station, should be extensively planted when its excellent qualities are more widely appreciated. It bears annual crops of beautiful red apples that ripen at the season of the Yellow Transparent, and are of high dessert quality.

Extent of Breeding Work

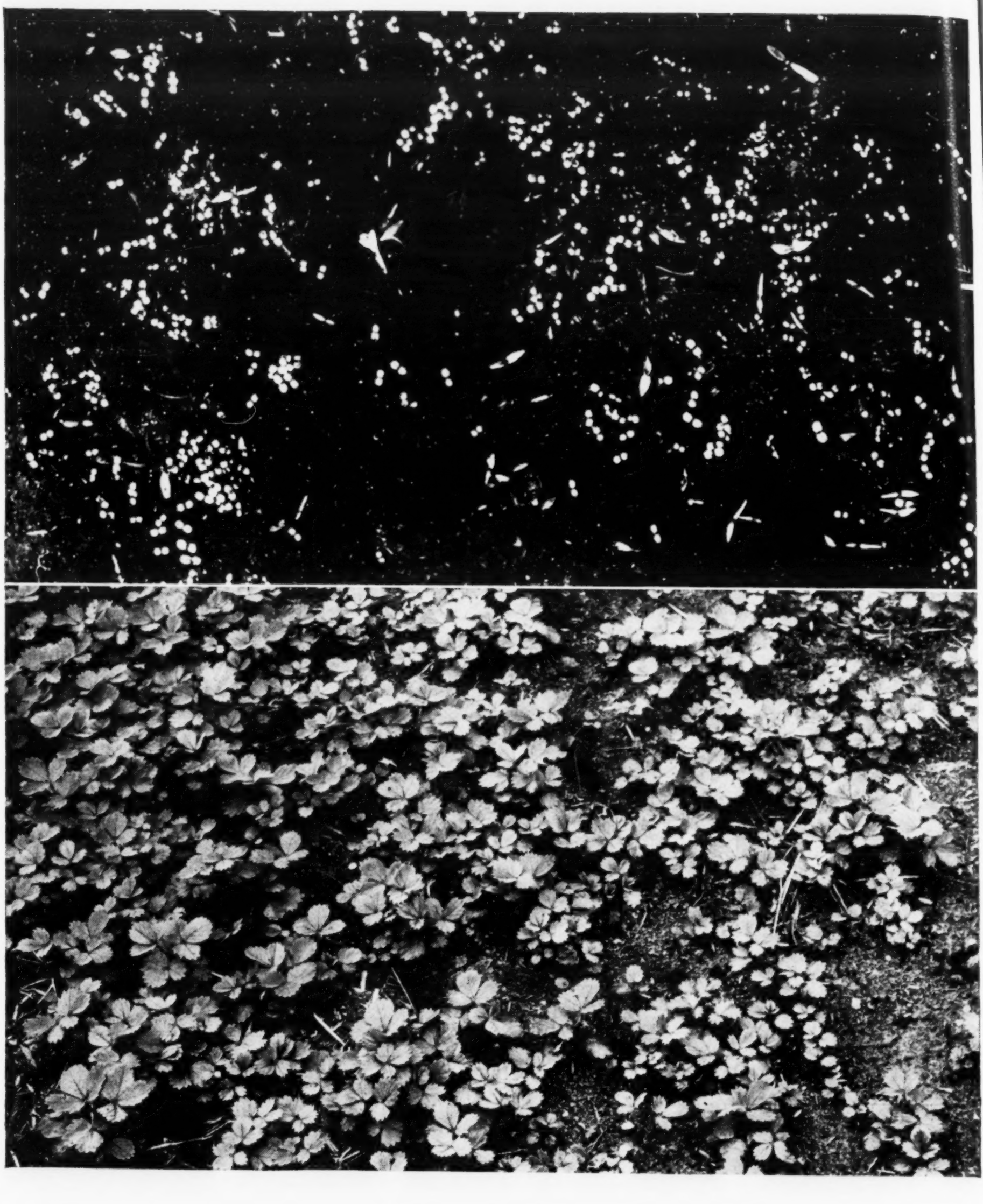
Undoubtedly, a number of really fine apples, some of which are destined to become the standard varieties of the future, will be sifted out of the large number of varieties already introduced, the selections now made and being further tested, and the seedlings now in bearing at experiment stations. The extent of the breeding work indicates the possibilities of new fruits from this source. For example; in 1923 the Illinois Experiment Station reported 20,000 seedling apples of 600 crosses set in the field for fruiting tests, and 139 selections already made and propagated. In addition, extensive peach breeding has been carried on by the station and 238 selections had already been made and propagated. At the Minnesota Fruit Breeding Farm 50,000 strawberry, 20,000 apple and about 40,000 other fruit seedlings have been raised. In 1925 it was reported that at the New York Experiment Station at Geneva over 60,000 seedling fruits had been grown and 80 varieties named and distributed. At the South Dakota Experiment Station the number of seedlings already having fruited will probably exceed 100,000, and 135 varieties have been named and introduced.

Fruit breeding work began soon after experiment stations were established and has been extended with the growth of those institutions. Though the Hunn strawberry, introduced in 1894, was the first variety known to have been introduced as the result of this work, the citrus and pineapple breeding by the United States Department of Agriculture, the raspberry work at the South Dakota and New York State Ex-

A WHITE FRUITED STRAWBERRY OF PROMISE

Figure 1

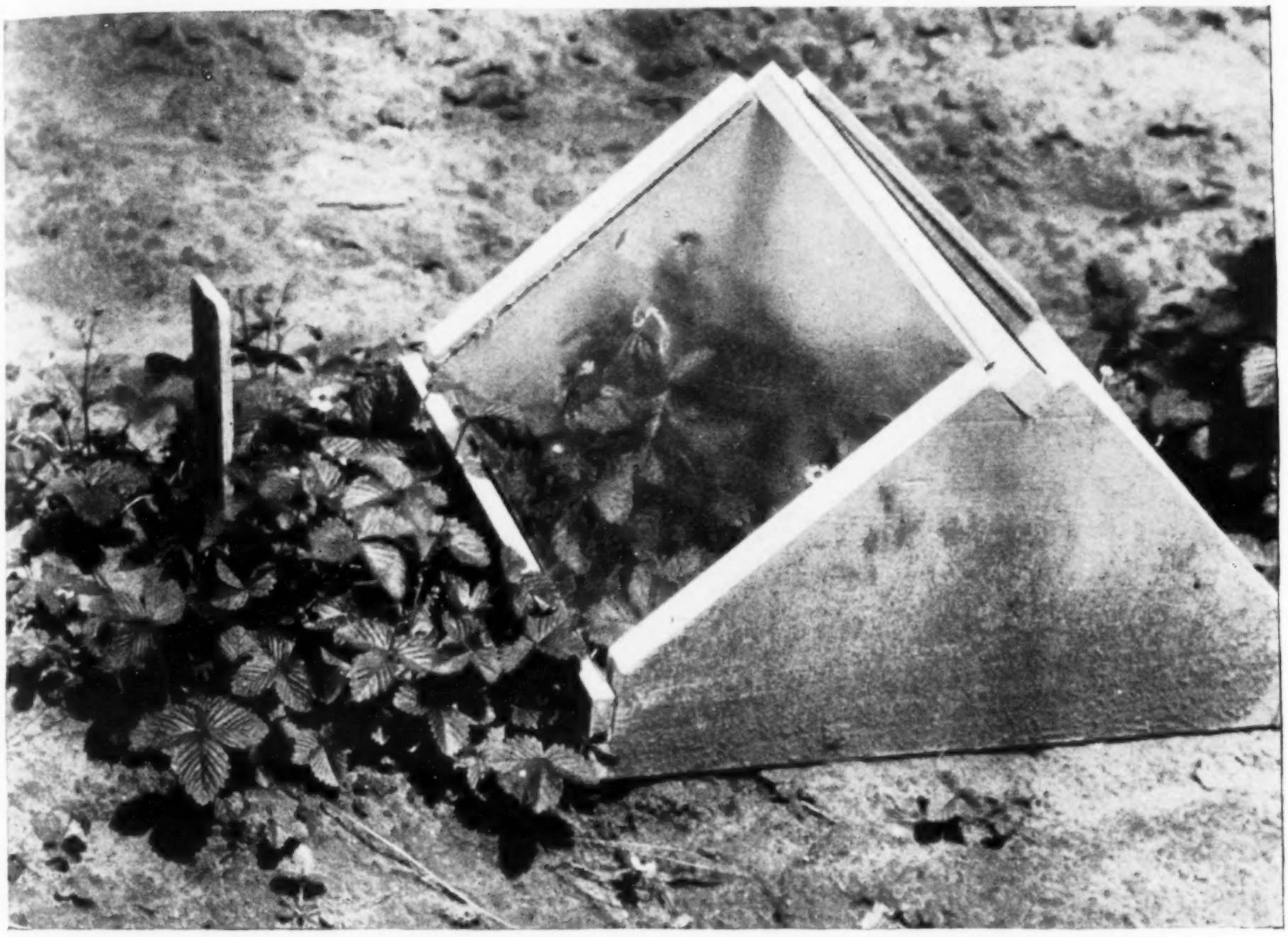
About 12,000 strawberry seedlings have been fruited at the Glenn Dale Station of the U. S. Department of Agriculture. From these a few hundred selections have been made for further testing. This white-fruited variety is among the best of these.



TWO STAGES IN GROWTH OF STRAWBERRY SEEDLINGS

Figure 2

The upper view shows a seed bed four days after "planting" the crushed fruits, though usually the period of germination is longer. Below is shown a later view of a seed-bed, when the young plants have begun to take on a more familiar appearance. Any one of thousands of such seedlings may mark the origin of a new variety of the greatest value.



FRAME USEFUL IN STRAWBERRY BREEDING

Figure 3

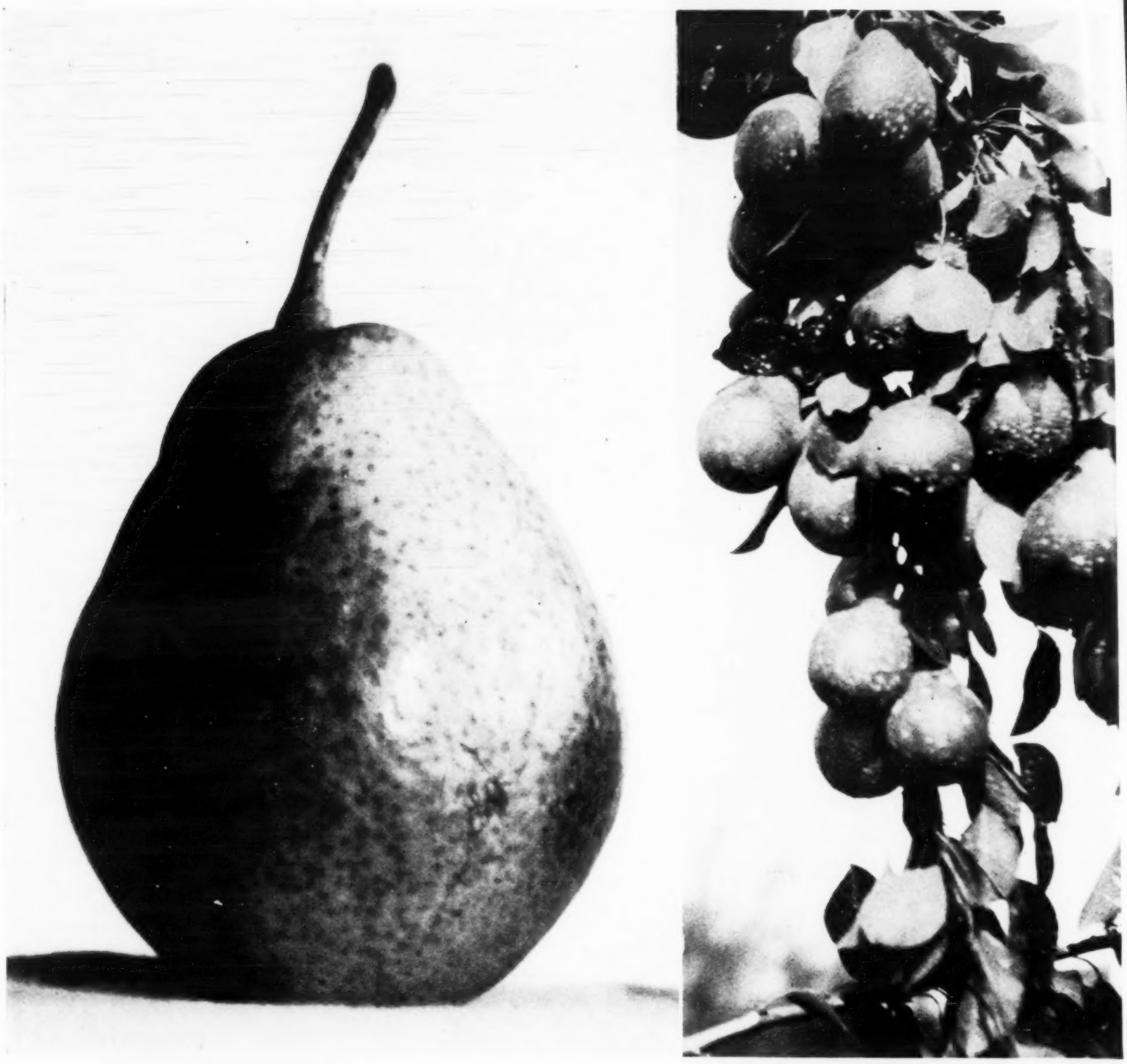
A frame ("suntrap") used to protect strawberry plants which are to be cross-pollinated. Flying insects are prevented from reaching the blossoms.

periment Stations and the grape work at the latter station were among the first to yield varieties which were introduced.

The extent of the breeding work being carried on and its constant increase prove that it can depend on continued and popular support. As a rule, the horticultural workers of the experiment stations have appreciated the possibilities of fruit improvement and have extended their work as fast as they have been provided with facilities. They have often been handicapped by not being able to visit and keep in close personal touch with other breeders. For this reason it is desirable that frequent surveys be made, which make possible a correct perspective of the work.

Difficulties of Selection

The number of apple varieties which makes up the apple industry total many hundreds, but the really important sorts number hardly more than a score. There is, however, need for additional varieties which are adapted to regions where those now in existence are not entirely satisfactory. There is also a need for others adapted to specific uses in regions already, in general, well supplied. These considerations do not make any easier the decision of the fruit breeder in regard to the value of a new variety. For example, the New York Experiment Station has introduced 28 new apples in the last twelve years. New York State is already well supplied with apple varieties and it does not seem likely that these new ones will replace all or many standard sorts. The judgment of the experiment station workers was that they were meritorious on the station grounds and that only a thorough trial in the various sections of the State would determine



THE PATTEN PEAR

Figure 4

Introduced by the Iowa Experiment Station. It is blight resistant, very hardy and shows great promise for the states of the Upper Mississippi Valley. The productivity of the variety is indicated by the heavily laden branch at the right.

their true worth. As these varieties are more extensively tested, the workers will have an increasing volume of data on which to base a decision as to which sorts will fill the needs of the industry.

Already, 74 apple varieties have been named and introduced, while at two stations alone—Illinois and Minnesota—it is reported that over 850 selections are being tested. Extreme conservatism in the introduction of new varieties is desirable because the fewer the varieties introduced which have no place in the industry, the greater will be the confidence of growers in the suggestions of the experiment stations, and the sooner will the truly valuable originations become prominent. Frequent visits, the exchange of new varieties by breeders, and close contacts of the workers with the fruit industries will be of greatest help in reducing the number of errors.

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Canadian Fruit Breeding Activities

In Canada, fruit breeding work was begun in 1887 at the Central Experimental Farm at Ottawa, Canada. It has been perhaps even more extensively followed than in the United States and its effect on the life of Canada is as great as in this country. From this experiment station alone more than one hundred new varieties of apples alone have been named. The Province of Ontario maintains a fruit-breeding station at Vineland Station, Ontario, where it has raised tens of thousands of seedling fruits and introduced several to the trade. Some of these Canadian fruit varieties are already being grown commercially in the States and fruit growers will do well to follow the work in Canada as well as that of the state stations. Only a summary of the work of the experiment stations in the United States, however, can be attempted here.

Summary of Breeding Work

Alaska—Strawberry Breeding.—Almost all the varieties of strawberries grown in Alaska were originated at the experiment station. Varieties from the States were of little value either in the humid coast regions or in the severe climate of the interior. By hybridizing these with the native wild coast and interior species, types adapted to both regions have been developed. As reported in Bulletin No. 4, issued October, 1923, these new sorts were selections from 11,614 seedlings. They are listed under numbers only.

California—Citrus and Peach Breeding.—Some peach breeding, and quite extensive citrus breeding, has been carried on by the Citrus Experiment Station at Riverside, Calif. About five thousand citrus seedlings from selfing and from cross pollination have been raised and are now being fruited and studied. None has been introduced though several seem promising. Selections of the peaches have been saved for use in future breeding.*

Georgia—Grape and Peach Breeding.—Muscadine grape breeding has been carried on at the State Experiment Station at Experiment, Ga., since 1909. About 3,500 vines have been brought into fruiting though many thousands of seedlings were raised and discarded as soon as the fruit color could be foretold from the leaf color. In 1919 six varieties, Hunt, Irene, November, Qualitas, Spalding and Stuckey were introduced. Other promising seedlings have been given numbers. In 1916 about 500 Elberta peach seedlings were raised from which were propagated and introduced four unnamed selections in 1923. One of these has since been named Roberta.

Idaho—Apple Breeding.—In the annual report of the station for 1923 it was stated that 1,790 seedling apples had fruited and that selections were being made. In 1925 some 2,150 seedlings fruited and were studied.

Illinois—Apple, Peach, Raspberry and Gooseberry Breeding.—In the annual report for 1923 it was stated that 20,000 apple seedlings of 600 crosses were in the field and that 139 apple and 238 peach selections had been made from these seedlings. Ten trees are propagated of each selection and are to be fruited before final selections are made. The apple breeding grounds alone occupy 135 acres and in 1925 over 400 selections considered worthy of further trial had been made. In addition, some raspberry and gooseberry breeding is being carried on. About 1,200 raspberry crosses were expected to fruit in 1926.

Iowa—Apple, Pear and Plum Breeding.—In the annual report of 1923, 5,000 apple seedlings of 120 crosses were reported to have fruited and 11 varieties had been propagated and distributed. These were named Adel, Afton, Ames, Hawkeye Greening, Macy, Monona, Secor and Sharon. Additional varieties named are Edgewood, Earlham and Maud. In 1923

*Horne, Wm. J. et al. Resistance of Peach Hybrids. *Journal of Heredity*, 17:99-104, 1926.

THE PIONEER BLUEBERRY

Figure 5

The first of the hybrid blueberries selected and approved for propagation from the blueberry-breeding work of Frederick V. Coville of the U. S. Dept. of Agriculture. Its parents were two selected wild plants of the highbush blueberry, *Vaccinium corymbosum*, one of them, named Brooks, from Greenfield, N. H., the other, named Sooy, from Browns Mills, N. J. The pollinations were made in 1912. Pioneer is a mid-season variety, its berries very sweet and delicious, without acidity when ripe, occasionally reaching a diameter of three-fourths of an inch.

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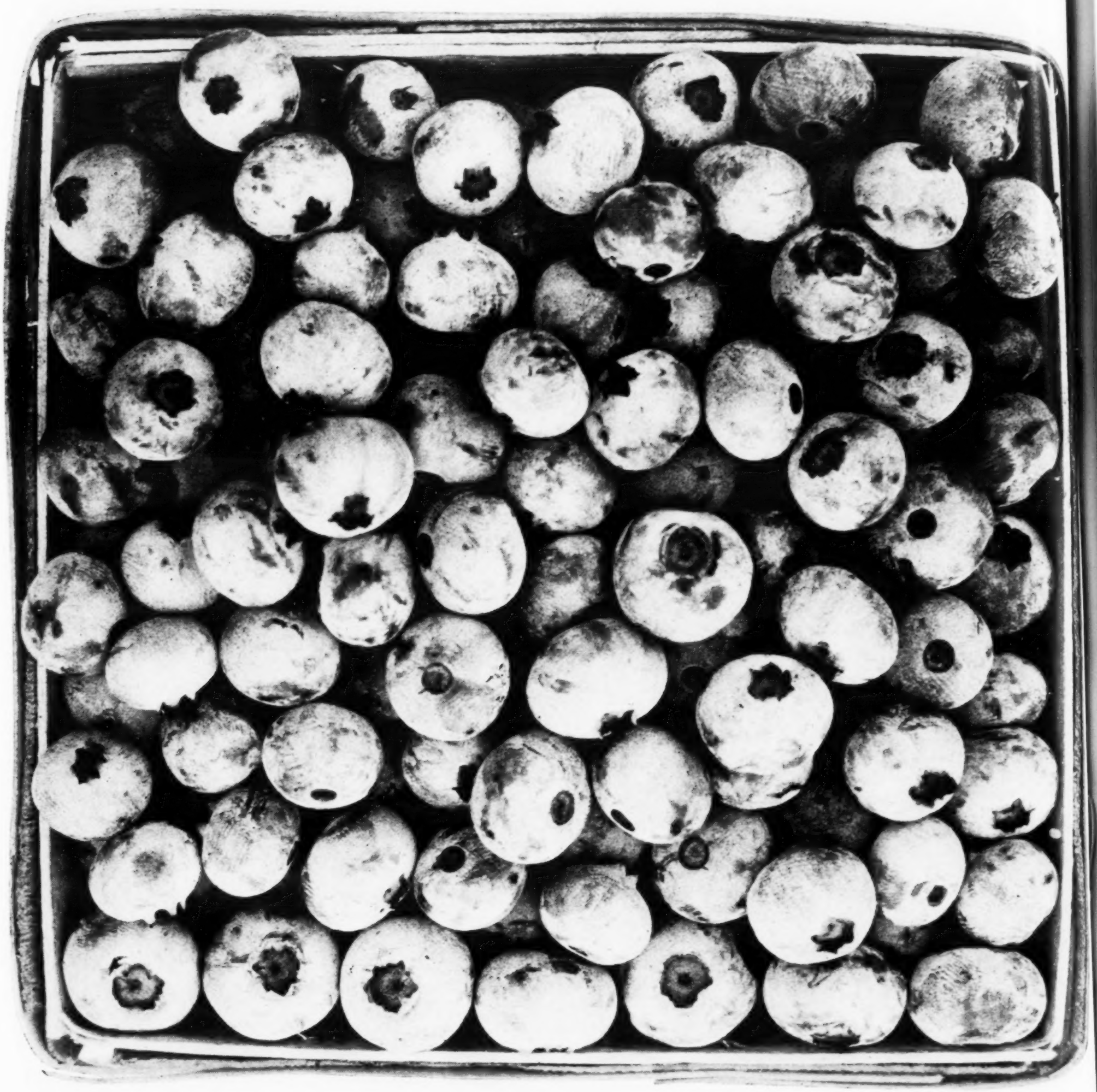
THE CABOT BLUEBERRY

Figure 6

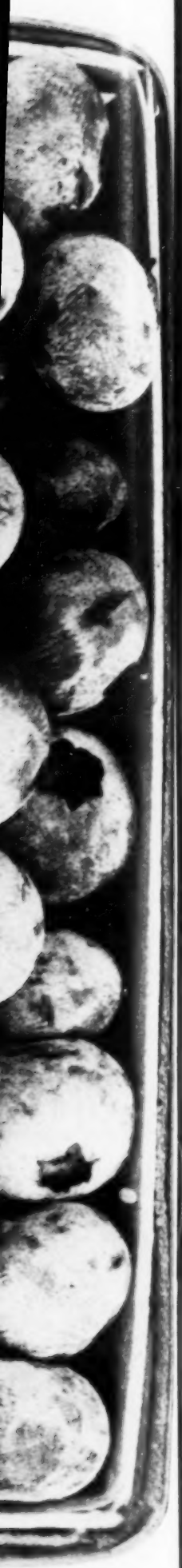
This variety, bred by Frederick V. Coville from pollinations made in 1913, is a first-generation hybrid between two selected wild plants of the highbush blueberry, *Vaccinium corymbosum*, one of them named Brooks, from Greenfield, N. H., the other named Chatsworth, from Chatsworth, N. J. It was named for Dr. Coville's son, Cabot Coville, who chose it for its delicious, sweet-subacid flavor from hybrids of this parentage. It is the earliest in season of the selected hybrids commercially grown in New Jersey. Its berries, although usually a little smaller than those of the hybrids Pioneer and Katharine, occasionally reach a diameter of three-fourths of an inch.



A LATE HYBRID BLUEBERRY

Figure 7

An unnamed hybrid, No. 1443A, bred by Frederick V. Coville, the pollinations having been made in 1916. The parents were two wild New Jersey plants of *Vaccinium corymbosum*, Grover and Rubel, found by Elizabeth C. White of Whitesbog, N. J. It is to be observed that seven berries reach across a 5-inch box. In 1926, this variety produced still larger berries, the largest being a little more than seven-eighths of an inch in diameter. This variety is later in season than any variety now grown commercially, and its berries retain more acidity when ripe than any of the others.



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3,000 seedling apples of 67 different crosses were set in the fields; in 1924 and 1925 about 5,500 additional seedlings, while some 2,000 additional trees were still in the seed beds and nurseries. In 1920 there were reported 1,200 pear seedlings, and in 1921 two varieties had been propagated and distributed, one of which has been named the Patten. Some 300 to 400 additional pear seedlings have been planted for a fruiting test as well as 200 to 300 plum seedlings.

Maryland—Apple, Pear and Grape Breeding.—In a report on apple and pear breeding in the *Report of the American Society for Horticultural Science* for 1920, 1,368 pear seedlings were reported as set in the field, some of which had fruited and 1,073 apple seedlings set in the field. Of 166 crossed apple seedlings which fruited, 24 appeared very promising, and of 90 open pollinated fruit only 2 were marked as promising.

Minnesota—Apple, Plum, Cherry, Grape, Currant, Gooseberry, Raspberry and Strawberry Breeding.—The first varieties from the Minnesota Station to be named were listed in the annual report of that station for 1920 as follows:

Minnehaha—apple
Elliott—plum
Monitor—plum
Red Wing—plum
Tonka—plum
Underwood—plum
Duluth—(everbearing) strawberry
Minnehaha—strawberry
Minnesota—strawberry
Latham—raspberry
Zumbra—cherry-plum hybrid

In the same report it was noted that 450 apple selections had been made. In the report for 1921 the following were named:

Folwell—apple
Wedge—apple
Anoka—plum
Mound—plum
Winona—plum
Como—gooseberry
Chaska—strawberry
Deephaven—(everbearing) strawberry
Easypicker—strawberry
Nokomis—strawberry

In the report for 1922, the Haralson apple and the Goldenrod plum were listed. In 1923, the La Crescent, Hennepin and Waconia plums, the St. Anthony cherry-plum hybrid, the Newport ornamental purple-leaved plum and the Manitou ornamental peach-almond hybrid, were named. In 1924, the Mendota plum; in 1925, the Radisson plum and the Nicollet cherry-plum hybrid were named.

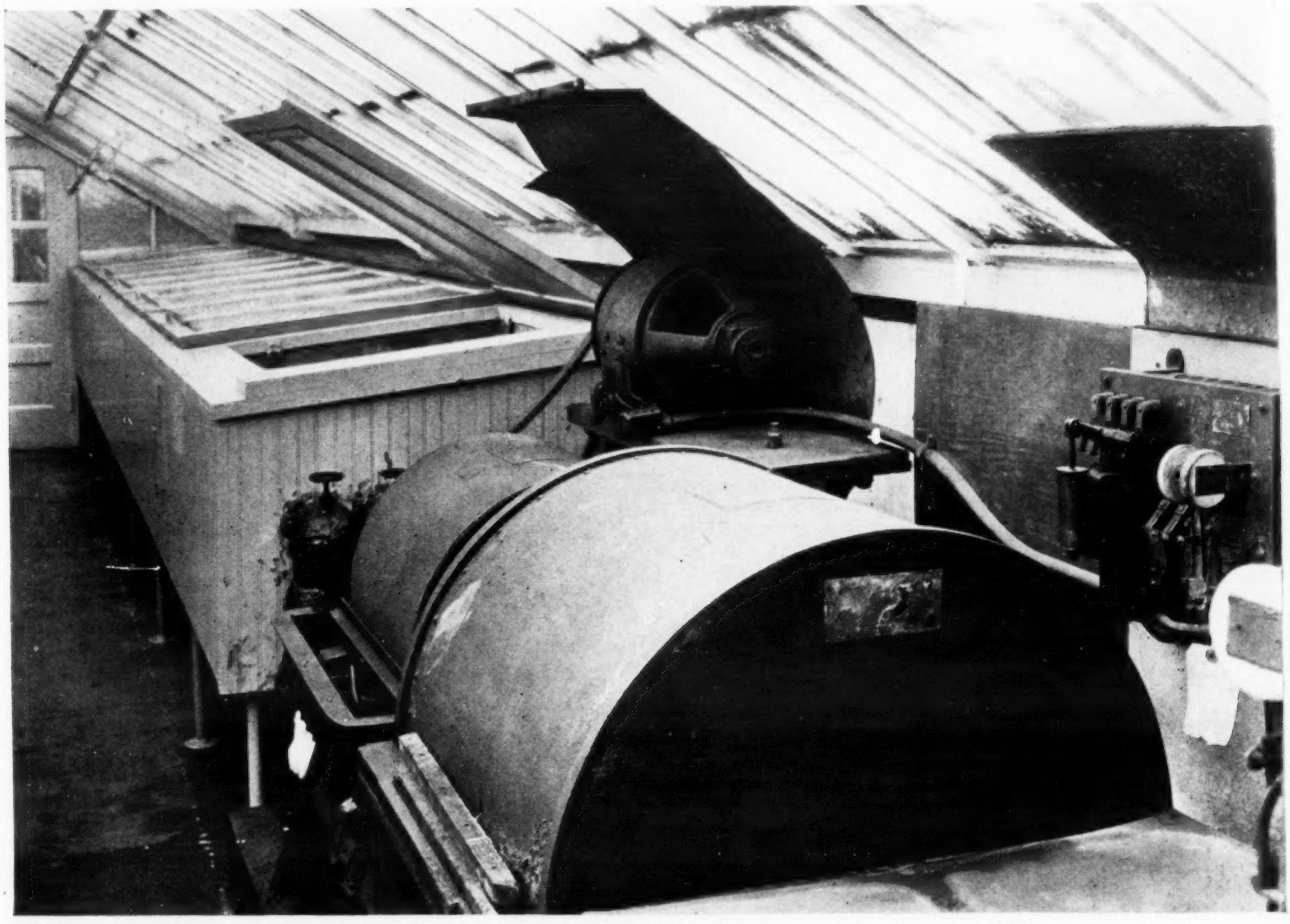
This station reported having grown 109,000 seedlings since the work was established, from which 32 varieties have been selected and introduced. In 1925, there were 27,960 seedlings on the breeding farm from which many new selections had been made for propagation.

Missouri—Apple and Peach Breeding.—The second generation of peach seedlings is being grown.

New Jersey — Peach Breeding.—In the *Report of the American Society for Horticultural Science* for 1922 it was reported that about 125 selections were under extended test at the station and at some 40 places at various parts of the State. One, the Pioneer, was named in 1923. Thirteen of these were named in 1925—Cumberland, Delicious, Eclipse, Goldfinch, Jubilee, Marigold, Massasoit, Meteor, Oriole, Primrose, Radiance, Rosebud and Sunbeam, and one, Buttercup, is being named this year (1926). These 15 varieties have been selected from nearly 2,000 seedlings actually fruited.

New York (Geneva Station)—Apple, Pear, Peach, Plum, Cherry, Grape, Currant, Gooseberry, Raspberry, Blackberry and Strawberry Breeding.—In the annual report for 1926 it was stated that 60-odd thousand fruit seedlings had been grown and about 80 selections named and distributed. The list of originations follows:

1894—strawberry....Hunn
1906—grape.....Goff
1908—grape.....Ontario
raspberry.....Donboro
raspberry.....Louboro
raspberry.....Marlative
raspberry.....Marldon
strawberry....Prolific
1909—raspberry.....June



A CHILLING FRAME

Figure 8

A 25-foot frame in one of the Department of Agriculture greenhouses at Washington, devised and constructed in 1916. It is kept at any desired degree of cold by an electrically driven, automatic, sulphur-dioxide refrigerating machine. By the proper use of this chilling frame, which provides an artificial winter, Dr. Coville brings into flower on the same date any two kinds of blueberry he desires to cross-pollinate. Other instructive experiments conducted with this apparatus are described in a paper entitled, "The influence of cold in stimulating the growth of plants," published in the Smithsonian Report for 1919.

1910—	strawberry	Magnus
	strawberry	Quality
1912—	grape	Portland
	grape	Ripley
	grape	Urbana
	grape	Westfield
1914—	apple	Broome
	apple	Clinton
	apple	Herkimer
	apple	Montgomery
	apple	Nassau
	apple	Otsego
	apple	Rensselaer
	apple	Rockland
	apple	Saratoga
	apple	Schoharie
	apple	Ulster
	apple	Westchester
1915—	apple	Chautauqua
	apple	Cortland
	apple	Onondaga
	apple	Oswego
	apple	Schenectady
	apple	Tioga
1918—	raspberry	Ontario
	strawberry	Addison
	strawberry	Alden
	strawberry	Arcade
	strawberry	Angola
	strawberry	Argyle
	strawberry	Ashton
	strawberry	Athens
	strawberry	Aurora
1919—	grape	Brocton
1920—	grape	Dunkirk
	pear	Cayuga
	pear	Canadice
1921—	grape	Sheridan
1922—	grape	Pontiac
	raspberry	Cayuga
	raspberry	Owasco
	raspberry	Seneca
1923—	grape	Keuka
	grape	Melton
	strawberry	Beacon
	strawberry	Bliss

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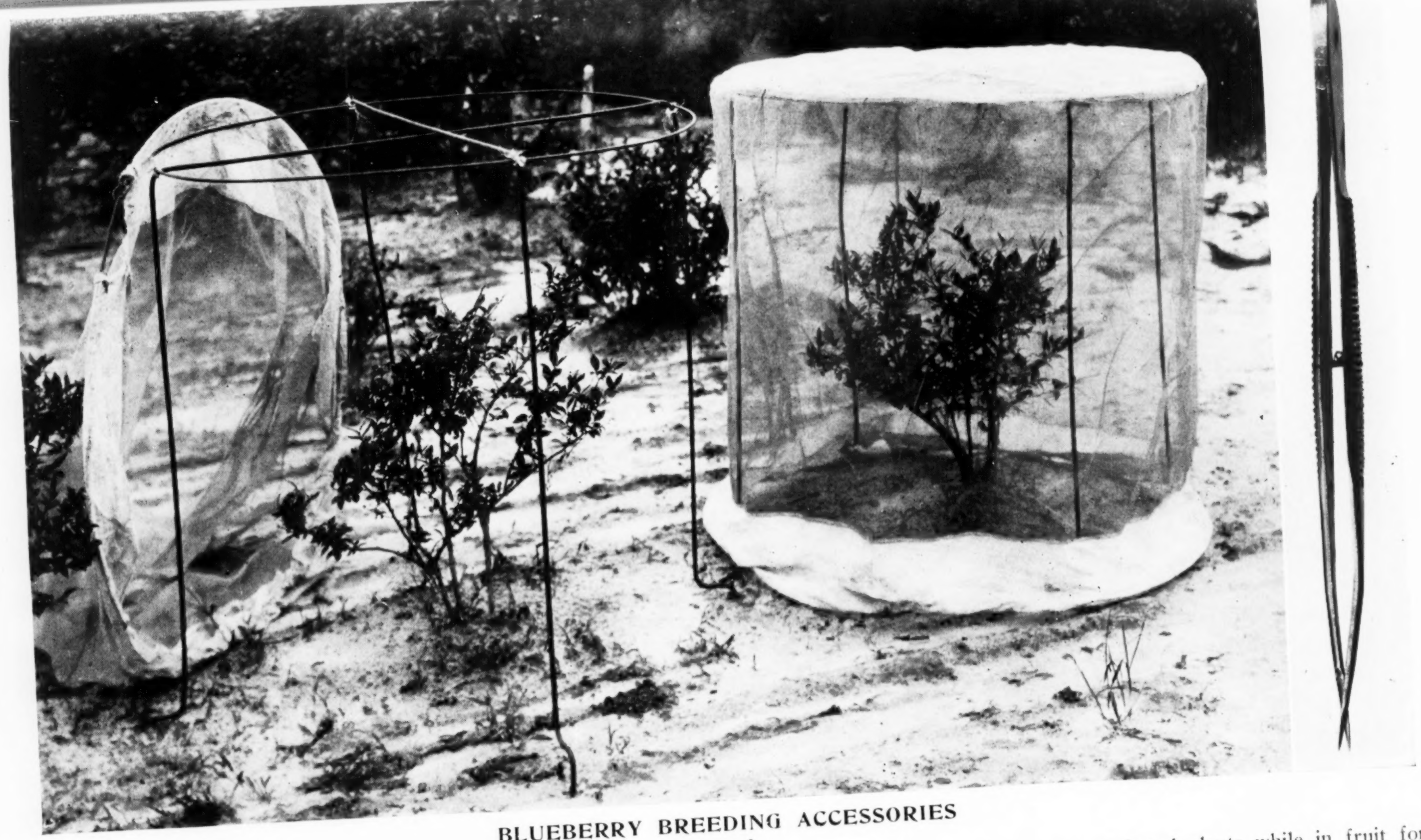

BLUEBERRY BREEDING ACCESSORIES

Figure 9

Cage used in the blueberry breeding work of the United States Department of Agriculture in protecting selected plants while in fruit for further observation and study. The cheesecloth cover shown at the left fastened to an iron ring, is dropped over the iron frame and rests on the ground. The points of the frame are forced into the ground by the foot as far as the offset. Photograph taken at Whitesbog, N. J., by C. J. Brygger. *Insert at right*: Forceps used for the removal of floral parts in emasculation of flowers. The tips are ground so that they function as scissors.

	strawberry	Bouquet
1923—	apple	Early McIntosh
	apple	Macoun
	apple	Medina
	apple	Milton
	apple	Sweet Delicious
	apple	Sweet McIntosh
	apple	Astrachan #2391
	apple	Delicious #1940
	apple	Yellow Transparent #2573
	pear	Gorham
	plum	Hall
1924—	apple	Lodi
	apple	Red Sauce
	apple	Orleans
	pear	Bartlett #1619
	cherry	Seneca
	nectarine	Hunter
1925—	pear	Phelps
	pear	Pulteney
1926—	raspberry	Brant
	raspberry	Dundee
	raspberry	Webster

North Carolina—Grape and Dewberry Breeding—Muscadine grape breeding has extended over a period of many years. Approximately 10,000 seedlings have been raised especially for inheritance studies. Twelve of these are being propagated for further testing, but none have been introduced. Dewberry breeding has recently started. No varieties have been introduced.

North Dakota—Strawberry Breeding—In the annual report for 1923 it was reported that more than 100 seedling strawberries had fruited and that selections had been made. One variety has since been introduced as Dryweather.

Oregon—Apple, Pear, Prune, Cherry and Strawberry Breeding—In the 1922 report it was stated that several hundred apple seedlings had fruited and that all were discarded, while 300 more were just coming into bearing; all but one or two of these have since been discarded. Pear seedlings were then fruiting for the first time, of which one has some promise. One prune and several cherry selections had been made. Some 2,000 crosses on the Etter 121 strawberry were obtained. Several of these strawberry crosses are promising and have been propagated and distributed. At the branch station at Talent, Ore., many thousands of pear seedlings of known parentage are being grown.

South Dakota—Apple, Pear, Plum, Cherry, Grape, Gooseberry, Raspberry and Strawberry Breeding.—The first of the many new fruits of this station was named and listed in 1907 in a circular entitled "Some New Fruits." The following is the list of sorts named and introduced, together with the year of their being listed or introduced:

1907—	raspberry	Sunbeam
1908—	plum	Assiniboin
	plum	Hanska
	plum	Huya
	plum	Sapa
	plum	Skuya
	plum	Tokeya
	plum	Topa
	plum	Wastesa
	plum	Winnipeg
	plum	Yuteca
	plum	Zekanta
	plum	Enopa
	plum	Etopa
	plum	Eyami
	plum	Okiya
	plum	Opata
	plum	Owanka
1908—	sand cherry x apricot	Yuksa
	sand cherry x peach	Kamdesa
	plum	Wakapa
	plum	Wohanka
1909—	plum	Inkpa
	plum	Kaga
1910—	plum	Cheresoto
	plum	Sansoto
	plum	Wachampa
	sand cherry	Cistena
1911—	plum	Ezaptan
	sand cherry	Stanapa
	plum	Toka
1912—	plum	Cikana
	plum	Kahinta
	plum	Oziya
	plum	Teton
	plum	Tokata
	sand cherry	Champa
	crab apple	Amur
	raspberry	Ohta
1913—	plum	Waneta
1916—	crab apple	Dolgo
	crab apple	Ivan
	apple	Adno
	apple	Hibkee
	apple	Sereda
1917—	plum	Cree
	plum	Kaw
	plum	Pembina
	plum	Ojibwa
	plum	Kiowa
	cherry	Moscow
	crab apple	Giant
1919—	crab apple	Alexis

	crab apple	Beauty
	crab apple	Cathay
	crab apple	Izo
	crab apple	Olga
	crab apple	Red Tip
	crab apple	Sugar
	apple	Caramel
	apple	Chance
	apple	Sasha
	pear	Gogol
	pear	Pushkin
	pear	Tolstoy
1920—	crab apple	Hopa Red-Flower
	crab apple	No-calyx
	crab apple	Sapinia
	apple	Anoka
1922—	crab apple	Kola
	crab apple	Linda Sweet
	crab apple	Maga
	crab apple	Shoko
	crab apple	Tipi
	crab apple	Zapta
	apple	Goldo
	apple	Oxbo
	cherry	May Day
	cherry	Tom Thumb
	raspberry	Fewthorn
	raspberry	Moonbeam
	raspberry	Smooth Cane
	raspberry	Spineless
	raspberry	Starlight
	raspberry	Twilight
1924—	crab apple	Into
	apple	Chinook
	pear	Saponsky
	gooseberry	Sunset
	cherry	Oka
1925—	grape	Arikara
	grape	Atkan
	grape	Azita
	grape	Caddo
	grape	Chontay
	grape	Chonkee
	grape	Edapa
	grape	Emana
	grape	Eona
	grape	Lachala
	grape	Luza
	grape	Mandan
	grape	Manota
	grape	Napka
	grape	Nompah
	grape	Oglala
	grape	Onaka
	grape	Pontigo
	grape	Osbu
	grape	Ree
	grape	Santee
	grape	Shakoba
	grape	Siposka
	grape	Sonona
	grape	Tahama
	grape	Teopa
	grape	Toscha
	grape	Washepa
	grape	Wakpala
	grape	Wecota
	grape	Wetonka
	grape	Yasota
1925—	gooseberry	Kawanka
	gooseberry	Kopa
	gooseberry	Kaduza
	gooseberry	Kazonta
	gooseberry	Kana
	gooseberry	Kataga
	gooseberry	Kanega
	gooseberry	Keza
	gooseberry	Kapoza
	gooseberry	Kabu
	currant	Atta
	currant	Mato
	currant	Tonah
	currant	Wanka

Texas—Raspberry-Blackberry Breeding.—Bulletin 326 discusses the blackberry-raspberry breeding work of this station. As the result of extensive hybridizing of the raspberry × blackberry eight seedlings of what is called the Nessberry have been introduced. These bear blood-red fruit of high quality which it is hoped will be for the South what the Logan is for the states on the Pacific Coast.

United States Department of Agriculture—Citrus, Peach, Pear, Prune, Date, Blueberry, Gooseberry, Grape, Currant, Raspberry, Blackberry and Strawberry Breeding.—The earliest extensive breeding work of the U. S. Department of Agriculture was begun in 1892 with citrus fruits and during the last twenty-two years over 10,000 seedlings have been grown and many selections are being tested, while the following varieties have been introduced:

1904—	citrange	Rusk
	citrange	Willits
	tangelo	Sampson
	tangerine	Trimble
	tangerine	Weshart
1905—	lime	Everglade
	lime	Palmetto
	citrange	Morton
1906—	ctirange	Colman
	citrange	Rustic
	citrange	Savage
	tangelo	Thornton
1911—	citrange	Saunders
1923—	citrangequat	Sinton
	citrangequat	Telfair
	citrangequat	Thomasville
	limequat	Eustis
	limequat	Lakeland
	limequat	Tavares

Pineapple breeding began about 1895

and the following varieties were introduced:

1905—Eden	1906—Biscayne
Gale	Coquina
Matthams	Dade
Miami	Deliciosa
Seminole	Orlando
	Jensen
	Jupiter

The date breeding work is located at Indio, Calif., and promising selections have been made. Peach breeding is located at Palo Alto, Calif., and at South Haven, Mich., and the pear work at Arlington, Va., South Haven, Mich., and at Palo Alto and Chico, Calif. The pear work now located at Arlington, Va., was begun about 1900 and some 3,000 seedlings raised. This work has lately been extended and some 10,500 seedlings have been secured. From the work at South Haven, Mich., probably 4,500 seedlings have been grown, some of which are beginnng to fruit. At Palo Alto, Calif., there are also a few hundred pear seedlings. Several selections of both peach and pear are being widely tested. Some prune, plum and apricot breeding is also being done at Palo Alto, Calif.

The blueberry breeding work is located at Washington and the principal field tests at Whitesbog, N. J. About 30,000 seedlings have been planted in the field and about 5,000 small ones are still in the greenhouse. The field-planted seedlings are hybrids from seven different species, while those still in the greenhouse included hybrids from three additional species. Four varieties have been distributed and their names have been published, Katherine in 1920, Pioneer and Cabot in 1921 and Greenfield in 1923. About a dozen additional selections are now under special test. All four named varieties have produced berries three-quarters of an inch in diameter, while two of the unnamed selections have produced fruit seven-eighths of an inch in diameter.

Some apple breeding has been done at South Haven, Mich., and at Arlington, Va.

The strawberry, raspberry and blackberry breeding work is located at Glenn Dale, Maryland. In the strawberry breeding work about 12,000 seedlings have been fruited and several hundred selections made for further testing. None has been introduced, though a considerable number are being widely tested. About 6,000 raspberry seedlings, including hybrids from eight different species, have been fruited and about 200 selections made. One variety, the Van Fleet, was introduced in 1925-1926 in cooperation with southeastern nurseries. About 1,000 blackberry seedlings, including hybrids from at least nine species, have been fruited and about a half dozen selections made. Mulberry, gooseberry and barberry breeding has also been engaged in.

Grape breeding is carried on at Willard, North Carolina, in cooperation with the North Carolina Experiment Station in an effort to improve the Muscadine grape. Several acres of seedlings have been fruited.

Apple, plum, cherry, currant, gooseberry, juneberry, grape and other breeding work for the Northern Great Plains regions is being carried on at an experiment station at Mandan, N. D. Several currant selections have been made and are being propagated.

IS THE HUMAN MIND STILL EVOLVING?

FREDERICK ADAMS WOODS

WHAT is to become of civilization if all the best stocks are dying out? This mournful question has been repeated over and over again. Fresh evidence is brought forward at every Eugenics Congress to show that the upper classes are not holding their own, that the'r birth rate has been falling and that if something is not done about it the better strains in European and American races will entirely disappear.

Both Darwin and Wallace towards the close of their lives felt a little gloomy as to the future of the evolution of humanity because it did not seem to them from such data as were then at hand that the old forces of natural selection—the survival of the fittest in the struggle for existance that had so successfully brought humanity up from the lower forms of life, would continue to be operative. Keen eyes and clever hands, superior brain and hardy physique would no longer be the decisive factors. Modern medicine keeps alive the defective, the sciences of optics and mechanics support the weak eye and the awkward hand, and the better brains do not reproduce their share of the next generation. But in nature it is always to be expected that some new correctives will be discovered to be at work when old forces have lost their power. The actual conditions are now found to be not so gloomy as commonly supposed. Indeed there is evidence from Harvard records which I propose to present here for the first time that a measurable evolution is going on at the present day, a natural selection leading towards a mental improvement. This will be a good thing for Harvard. A Princeton man might unfortunately, just at present, say this with a peculiar intonation; but in all probability the same process is at work in Princeton, and with all undue levity aside it appears likely from this and other evidence that it is all part of a wide and far-reaching general fact.

This general principle, or law, is that among human beings, people who are superior in one direction are, by-and-large, superior in every other direction. I am aware that this is contrary to popular belief; but it is nevertheless a truth supported by abundant evidence. Moral qualities are linked with mental qualities. Mental superiority, it has been found, runs hand in hand with physical superiority. Delinquent youths and adult criminals are below the average in intelligence. Students who are good in one subject are more than likely good in another. As a general statement it can be said that all good qualities are correlated; and as concerns important and usual human traits all investigators have confirmed this generalization. There will doubtless be found special exceptions to the rule, as for instance a weak resistance to typhoid fever and influenza may be actually associated with a superior muscular strength.

If mental qualities are on the average correlated with moral—i. e., good people average to be brighter than bad people it may help along mental evolution for the following reason. It is highly probable that within any one grade of society the dissolute, immoral or otherwise anti-social members have fewer children to reach adult years than do the domestic, the kindly and normal. Such a view is certainly, merely as an assumption, not unreasonable. Recorded proof of this fact has been difficult to obtain. The only figures as far as I know are those I published in 1903 taken from records concerning the Royal Families of Europe, reprinted in *Hereditу in Royalty*. Here it is very clear that those in the

better moral grades reared many more children to maturity than did those in the lowest.'

I never came upon an easy way of confirming this research until one day in 1925 I was strolling about the library of the Harvard Club in New York. I was looking at some of the anniversary records of the classes graduated twenty-five years, and was much struck by the completeness of the books and of the collection as a whole, and the added interest from the insertion of photographs taken of each, at the time of graduation and taken a quarter of a century later. The twenty-fifth is considered the most important anniversary. After that too many are gone. It is a sort of "show down' of life's accomplishments. The cards are all on the table mostly face up. The classmates are for the most part about forty-seven or forty-eight years of age, and their lives are settled. Further distinction, unknown successes and failures may lie ahead, but not many will be the parents of any more children.

It may interest the reader to see that a statistical enquiry may sometimes be more like a game or puzzle than like the work of a machine and contain an element of excitement when you are hoping to confirm a theory. So I shall tell it as a story and leave out charts and tables.

Satisfactorily complete records appear in these anniversary books as to marriage and the total number of children both living and dead. I chanced upon the volume for the class of 1894. It seemed to me that there would be an excellent opportunity to see if there were any relationship between the number of adult children and mental superiority. "Who's Who in America" is always near at hand to tempt the social statistician. Of course "Who's Who" is no perfect test either of mental superiority or of what is commonly known as success, but still I suppose anyone would grant that the classmates in "Who's Who in America" would average more success than those who were not included. At any rate, this is what I did, and this is what I found. I predicted in my own mind that those who had four or more children would be more often in "Who's Who" than those who had less, and I found that for the class of 1894 (parents still living) 25.5 per cent of the parents of such large families were honored in Who's Who, while for the unmarried, the percentage sank to 6.3 per cent, a very striking difference. One is over four times the other. This made an encouraging beginning. The next step was to see if those who married, but had no child, would show a percentage of distinction lower than the fathers of the large families. They did. Their figure came out just 20 in comparison with 25.5. The percentage for the parents of one, two, and three children respectively, should lie between 20 and 25.5 in a series of slight rises. The figure for the fathers of three children came out 22.5 per cent included in "Who's Who," which was too good to be true. It may be difficult for the non-mathematical reader to comprehend, but it is almost impossible for all these six groups to fit in just as they should, each showing a proportionate rise even if the idea be entirely correct. The reason is that the total number of graduate students in one year is not large enough.

The percentage for the parents with two children proved to be 18.1, and for one child, 13.3. The figures on the whole seemed very significant and it appeared worthwhile to add more records to the total to see if confirmation could be obtained and a smooth rise demonstrated.

The class records for the twenty-fifth anniversary of the class of 1898 were next examined. Here all the percentages were found to be lower than for the class of '94, due presumably to the four years difference in their ages, since the "Who's Who in America" for the years 1924-5 was used for both groups. Again the unmarried showed the lowest and the fathers of

four or more children the highest ratios. I then tried the class four years earlier than '94, the class of 1890. Here the total per cent in Who's Who is greater, due probably to their more advanced age. The highest ratio was found for the parents of three children and curiously enough in the class of 1890 the bachelors beat the parents of four or more children 15.2 to 14.3. If I had happened to pick up this class book first I probably never would have carried the investigation any further, imagining that even if the correlation between mentality and fecundity did exist it would be small and difficult to prove.

The three classes added together gave, however, an almost smooth rise. For classes earlier than 1890 the records for marriage and the number of children are not complete. Later than '98 the percentage in Who's Who is necessarily small.

I added the story from 1892 and now, combining the four series of records, I feel practically sure that those who have the most children are the ones on the average who achieve the most success. Those who at some time in their lives marry but never have any offspring are about in the same standing as the parents, but the falling off for the unmarried is very marked. The figures run 9.7 for bachelors, 16.4 for married but childless, then 16.9, 16.8, 18.9, and 18.1 for one, two, three, four or more respectively. It will be seen that there is hardly a break in the series of steps, the only case being a trivial one, since 16.8 should come before 16.9. I had thought to add the class of '96 thus completing all the even numbered classes from 1890 to 1898. It is, however, not necessary, and I have not recently had any opportunity to do so.

With this comment I agree though I do not believe that the figures are entirely due to any one cause. It would seem from the general impression gained in going through the volumes and reading parts of the autobiographies that there were a good many of a lazy indifferent type. They had done very little that was interesting. They wrote very little about themselves. There did not seem to be much to write about. Very frequently this type remained unmarried. It seemed that perhaps they were unwilling to make the effort to marry or to do anything else. In a way, this might be given as a chief cause, but the most we can say with certainty is this: there is certainly a correlation. The two facts, high birth rate and achievement are related to each other. The causes of correlations are usually complex. It is not impossible that having more children to support stimulates a man to greater effort. Of course the environmentalists will at once give that as the reason. I do not believe it to be more than a possible minor factor. In the first place it is just as good a bet to suppose that gifted, ambitious, self-seeking persons gain more than their share of success and that their selfishness prevents their marrying, or if they do marry prevents their having children. We do not know what is a stimulus and what is not, what is a favorable environment and what is not, though some people talk glibly enough about all these obscure and complicated matters.

All that we know is that we are continually finding correlations that fit in well with the doctrine of predetermined differences in the germ-plasm as the chief cause of human differences. Some of these results can be equally well explained by outward circumstances, some of them can not. Nearly all of the important human differences are in accordance with heredity. For instance in discussing the cause of the present correlation, it seems better to call it heredity than environment, since heredity can explain the facts both for the royal families and for the college graduates, and environment can not at all well explain the series of figures found among royalty. It would be, I suppose, asking too much even of the most extreme environmentalist to consider that a king who

had three children should through this circumstance be made more virtuous than a king with only one child!

Whatever be the cause there seems no doubt about the main facts, and I have recently received a letter from Dr. John C. Phillips of Boston saying that he is getting confirmation of my findings in some Harvard records that he had already been analysing for a different season. He writes in part as follows:

> I am just now grading three college classes 1 to 5 in respect to adult accomplishment . . . taking the tip from your work I am recording the number of children for each man with his grade. I have not yet assembled these figures. Only two classes are graded, but there is going to be a very significant result, I think. Grades 1 and 2, the successful grades, are going to show a lot more children than grades 4 and 5.

Dr. Phillips is the author of a widely quoted memoir on the birth rates of the offspring of Harvard graduates showing that college graduates are not, if taken *en masse*, leaving enough adult descendants to maintain their population. The number is less than two. Dr. Phillips does not state in his letter his method of grading "success," but it is significant that a method designed for a totally different investigation should yield this striking result.

We now have a curious, seemingly paradoxical situation. How can it be that the best individuals are having the most children when we can see all about us that the lower social classes are having more children than the upper? However, if these are the facts there will doubtless be found some way of reconciling them.

I believe that the real explanation is that the different classes of society are already very much separated from each other biologically. I use the word "biologically" to mean that the different classes do not often intermarry. If they do not much intermarry then to that extent each class may be studied as if it were a distinct variety—a group by itself. From this point of view if we made a study of the qualities of the parents and the total number of adult offspring in any one city block, even in the slums, we should expect to find the better parents rearing the greater number of offspring. All these considerations should make the outlook for Eugenics more encouraging, as they show that mental and moral evolution is going on at the present time.

Although quantities of books are appearing every month dealing with such subjects as human evolution, psychology, education, criminology, general sociology and the philosophy of history, very few of these show that their authors are acquainted with the researches dealing with the correlation of good qualities. Until they inform themselves in this field they will continue to misunderstand the whole outlook as regards humanity in its past, its present, and its future.

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POLLED AND HORNED CATTLE

ROBERT C. M. AULD

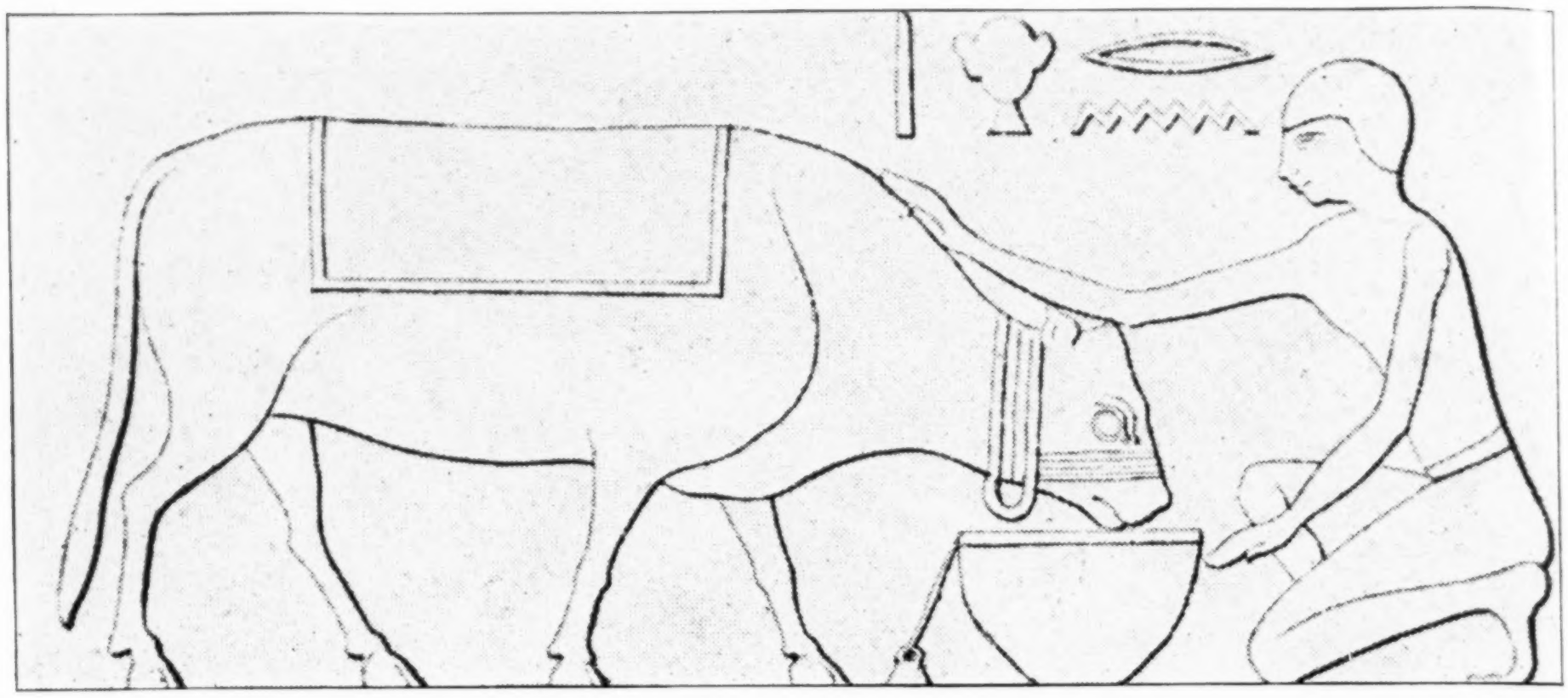
POLLED CATTLE ON MYTILINE COIN

Figure 10

Dating from about the fifth century B. C. The coin is in the British Museum, and is but one example of polled cattle to be found in this collection. The cattle on early Greek and Roman coins can in a great majority of cases be identified as definitely horned or definitely polled.

INNUMERABLE have been the shifts the authorities have been put to, to explain the polled, or hornless, character, in the bovine and other ruminant species. Much study has been bestowed on the question, and formerly it was pretty universally accepted that the polled or hornless character was a late condition, and that the horned character was the primal feature of the ruminant head. Science, however, has fully proved that this is the very reverse of the fact—that it was the polled or hornless condition that was the primitive condition, that it was not the polled condition which had to be explained, but the horned. That was rather startling, as it brought the hornless character to the front as an example of the basic condition of the ruminant skull, upon which developed the horns, as in deer, in regular augmentative succession and varying character. Thus, the evolution of the horns in the deer species became an instance equal to that of the evolution, or devolution of the five-toed animal from which the present one-toed equine became supreme. But that importance was rendered even insignificant with the rise of Mendelism, when it was established by Spillman of the U. S. Department of Agriculture that the polled character was dominant in cattle, which at once brought the hornless character to the very front rank of scientific importance.

Having studied this subject for nearly fifty years, it is the present object of the writer to place in some definite form the various views that appear to have been held in regard to hornlessness, in view of the importance to which the character has now scientifically attained. We find, for instance, R. Gibson, author of the article on "Cattle," in the Eighth edition of the *Encyclopædia Britannica,* in his classification, placing first, "Polled cattle, an artificial variety, which may be produced by selection." Dr. Alex. Smith, author of a paper on "Scottish Cattle," in the proceedings of the Society of Antiquaries of Scotland believes the "loss of horns to be an accidential peculiarity which might occur in any domestic herd." Sir Wm. Flower, curator of the British Museum, in "Fashion and Deformity," gave it as his opinion that polled cattle "have arisen from some accidental occurrence," in which opinion many others have concurred; but this is a view like most others of these days that students of the new heredity cannot and do not dare accept. The late Frank Buckland, of the Brighton Aquarium, came nearer the fact when he said: "Certain kinds of cattle are born naturally without horns." The



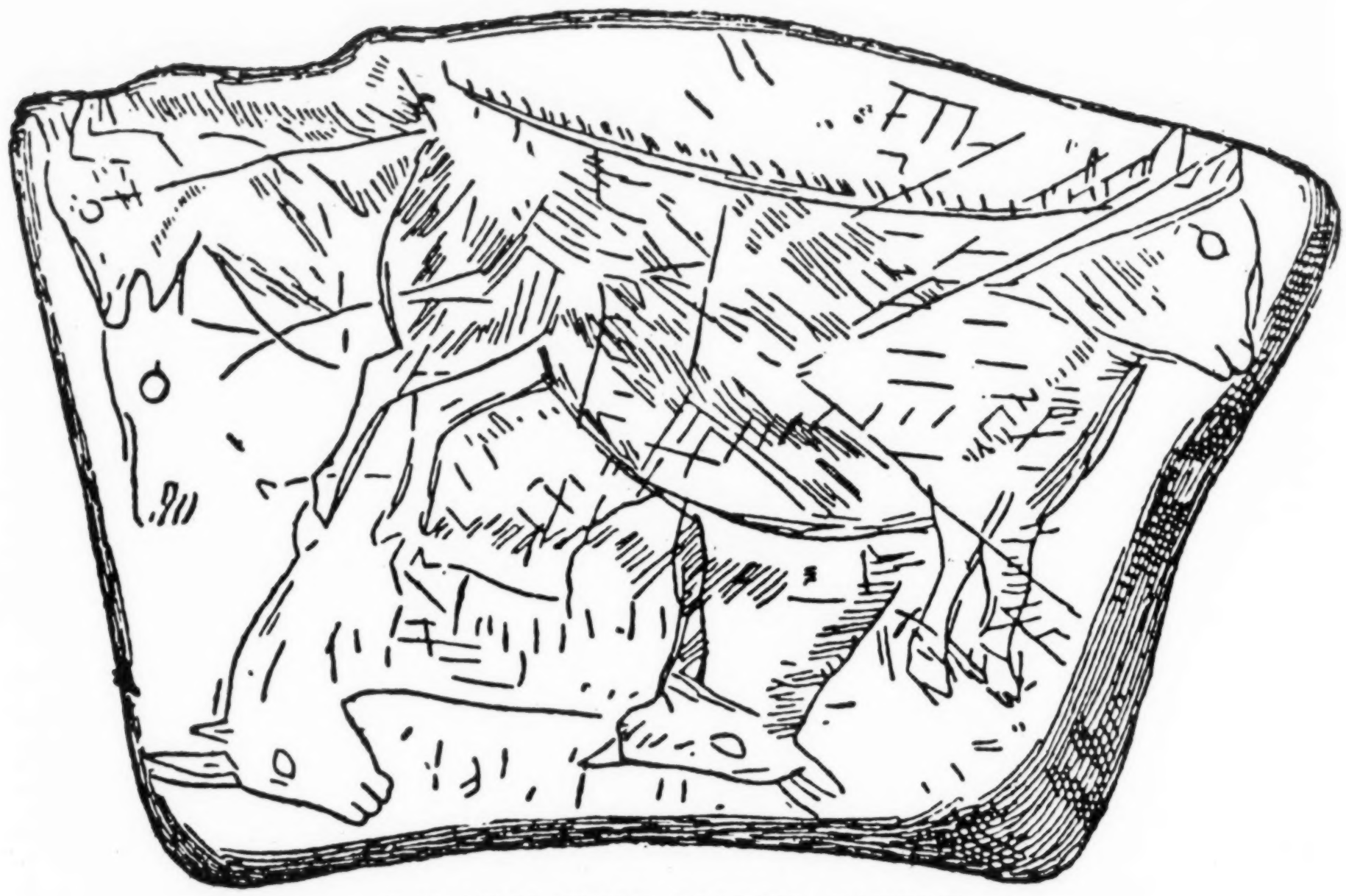
HORNLESS CATTLE OF EGYPT

Figure 11

The Egyptians recognized these types of cattle, as regards horns: naturally polled, dehorned, and horned.

character puzzled Darwin, who has been largely quoted on the subject; he apparently believing that "polled cattle appeared suddenly, by what in our ignorance we might call spontaneous variation. No one can give an explanation, though there must be a cause, of loss of horns, any more than the loss of hair, both losses tending to be inherited. It is, I think, possible that loss of horns has occurred often since cattle were domesticated, though I can call to mind only a case in Paraguay a century ago." Darwin was evidently little acquainted with the enormous number of cases recorded of the existence of the polled character in Europe and elsewhere; nor, apparently, of the discovery of fossil skulls, which would have given him the clue at once to the "explanation" he would have quickly made. The authors of the "History of Polled (Aberdeen-Angus) Cattle," following Darwin's view, which they obtained from him, believe that "the loss of horns may be due to organic changes which have given rise to our known polled varieties and that have really occurred since domestication began." This view was formulated even though they had the statement of Boyd Dawkins, who was, as far as we are aware, the first definitely to indicate the real explanation, which we find in his "Early Man in Britain," and other works and papers in the Transactions of the Scientific societies. He made very careful research into the whole subject of horns in regard to all horned (ruminant) species and placed himself on record thus: "The polled cattle I consider to be the result of selection, in which advantage has been taken of a *tendency to revert to an ancestral hornless type,* probably as far back as the Miocene age. I should expect to meet with them from time to time in every breed, just as a horse is from time to time bred with three toes, which have been derived from a remote ancestor, the Miocene anchitherium." Further, he writes: "It seems very likely that horns were originally a sexual character peculiar to the males and transferred to the females. This was brought about before the beginning of the Pleistocene age, since all oxen of that period possessed horns. If this view of the origin of horns be accepted it is easy to explain the singular ease with which, in a comparatively short time, the horns have been bred out of some of our domestic cattle by selection carried on through several generations, and our polled cattle may be looked on as a *reversion to an ancestral type,*" which type we shall be able to trace as we proceed, though he even points to *Bos etruscus,* which to him provided "the first instance of hornless ox." John Fiske, following the natural logical development of this evolution came to the same conclusion, his deduction being that "herds of hornless oxen roamed the plains of Asia and Europe during the Pliocene times." To ascertain the source of his information the writer was induced to communicate with him and a courteous response came from Cambridge, Mass., dated Dec. 24, 1897, which indicated that, as he wrote: "I had in mind Dawkins's 'Early Man in Britain,' 1st edition, p. 87." "The ox appears first in the upper Pliocene, but without horns." The later evidence would certainly have fortified Professor Fiske in his picture of these hornless grazing herds of the Pliocene age.

Assuming then, at this point, that the first bovines were of the hornless type —the scientific data for which will be presented in due form—we note the first explanation is that given by Boyd Dawkins, that the polled character was departed from in the first instance, by the appearance of horns in the males —which he explains as a sexual character—the "acquired" appendages being afterwards transferred to the female. Without discussing this "acquirement" and "transference" just now, we are reminded that it was Goethe, a foreshadower of the theory of natural selection, writing in 1794, who said "that the future question for naturalists will be, for instance, *how cattle got their*



PALAEOLITHIC POLLED CATTLE

Figure 12

Sketch of animals from a French cave containing relics of the Madelaine period, furnished the author by Dr. Pocock of the British Museum. He believes the figure of the bull exhibits a specimen of as fine a polled bull as might be seen at a London Dairy show. In his opinion the animal was *domesticated*.

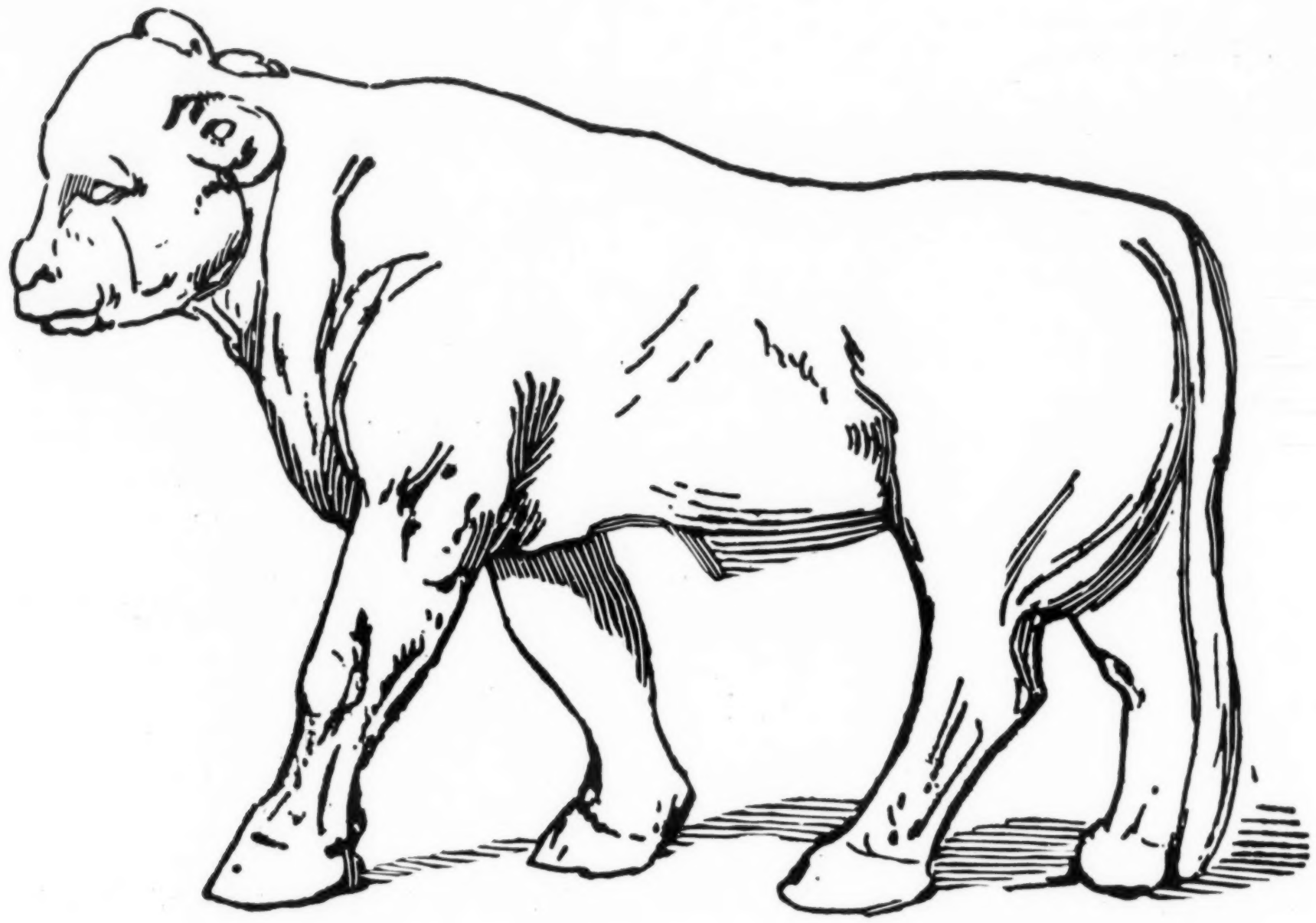
horns, not for what they are used."* That indeed has been the real question, for an answer to which naturalists have sought to penetrate Nature's so-called "blind" *purpose*. That the horns were "acquired" or developed as a sexual character, simply means that they were so developed to provide means of defense or offense in the function of the males of the herds in the sexual congress; as well as against their foes. The problem becomes, therefore, one of the necessity of at once explaining not the "loss of horns" but the natural "acquirement" (which term we use in a specific sense) of horns. Now, it is evident, from the countless herds of hornless Pliocene "oxen," that is, bulls and cows, that the use of horns was not really necessary for defense or offense, within the herd. All acquainted with the fighting tactics of polled bovines today know full well that the polled can fight more successfully against all horned opponents, destitute as they are of horns. The same with hornless or hummel stags, who fight their horned rivals by rising on their feet and bearing down on their antagonist: thus they avoid that terrible condition to which the horned stags are subject of becoming so entangled in each others horns, that they die of exhaustion in their struggles to free themselves. Thus sexual strife leading to sexual selection of horned specimens would have had no particular advantage in these Pliocene herds. Professor Primrose McConnell pointed this out quite clearly when he remarked: "The success of polled or bald males among the ruminants in sexual warfare proves that their frontal appendages are not of great use in this direc-

*Goethe als Nature forscher: von Dr Karl Meding.

tion, and, indeed, if the fighting between bulls and rams and stags be watched, it will be seen that it is in the butting or battering tactics which are adopted; and that their weapons rarely come into use at all, or only when one yields or is chased by another." Allan Gordon Cameron, writing from Barcaldine Castle, N. B. (*The Field*, Nov. 4, 1893), said, in regard to this: "The science of domestic warfare with Bos and Cervus remains, as in primeval times the science of the battering ram, and we have solid proof that the possession of the female does not depend upon the cranial armor of the male in the simple fact that a stag with no antlers will thrash any stag that has them, so long that he happens to be the heavier beast."

On the other hand, as McConnell also points out, "It is certain that hornless animals would stand little chance of survival in an age or country where carnivorous animals were common; polled breeds, therefore, must have evolved in comparatively recent times—though they are a reversion to an early type—and 'fossil' skulls of this kind must be looked upon with suspicion." It must have been the necessity of some means of defense against their carnivorous foes that multiplied with such rapidity that enabled them to fatten and reproduce themselves so well and plentifully during the happy days for them when the Pliocene plains were thronged with defenseless bovines, that Nature (turning the idea over in her mind!) as we are told came along and "furnished" the defenseless with weapons to protect themselves against these outside foes!

Here, then, we are up against the real problem: How horns came into existence? How came they to be *added* to the frontals of the bovines. This is the profound question. But it was instantly answered by the Lamarckian advocates of evolution: That it was as the result of the constant buttings of the bulls and batterings of the rams against each other. Buttings and batterings mean that the points of impact would be the frontal portion of the skull, so that if such batterings and buttings had anything to do with the inducing the flow of blood thereto and the consequent inducement of growth, the result would have been *unicorns*, not bicorns in which the horns appeared at points not affected by the impacts. It might be said—and we throw out the suggestion for the benefit of those who hold this idea, which, however, is of no account—that the frontal pushings and "heaguings"—as the Scottish phrase was for such pushings—might have diverted the juices that went to fertilize the corneous "soil" for the sprouting of the horns to the sides of the cranium. But, as all who have given this suggestion of the Lamarckian order a thought, the whole thing is altogether unreasonable. For does it not imply as well some predetermined (mental) conception on the part of the parents or of the germ plasm! of the possibility (?) of such a process on the part of the defenseless animals, who thenceforth entered a series of tournaments with each other to develop the champion batterers and bunters? The idea is on a par with the Lamarckian conception of the elongation of the neck of the giraffe for the purpose of browsing off the foliage of trees instead of straddling itself so ridiculously to reach the herbage on the ground. The Lamarckian theory is that by one generation stretching a little, and the next some more, and so on, eventually the long-necked individual would be developed! This, of course, as a result of the *willing* of such a thing by the first and subsequent generations, who would themselves gain nothing by their effort. The explanation puts the cart before the horse. For it would be by the natural development of longer-necked animals, breeding among themselves, that the result would be accomplished. And we do not mean that it was by the breeding of one longer-necked generation with another that produced a still longer necked generation: but that there was an inherent tendency toward the production of such



ASSYRIAN POLLED CALF

Figure 13

Sketch of bronze figure of polled calf, from Gosse's *Assyria.*

animals, that the species became "indebted" for its characteristic long neck.

Polled animals have what might be called "knobs" high on their frontals; which we might otherwise describe as cushions. They are not of osseous material but cuticular; and may be useful as buffers in the shock of onslaught. We all know with what a thud two polled males come together in such impacts. But when the first contact has occurred of skull against skull there is no more bumping, or battering (in bovines); it is a steady push of frontal against frontal, impulsed with all the weight of the body behind each, and the strength of thew and sinew in neck and thighs, as each uses his hind extremities—hoofs planted sturdily on the soil—to withstand the misfortune of yielding, as well as to enforce the forward movement of the stronger and more determined. At the very point when one yields in the very slightest there is a quick rebound of the victor as he comes instantly back with a great thrust at the side or heart of his opponent, which makes the latter turn in instant flight, while the victor bellows his triumph, as each had done his challenge. Fine descriptions of these bull fights occur—in the story of the Tain Bo, the Irish epic, as well as that given by Dr. James Anderson, F. R. S., (in his *Recreations*) and others.

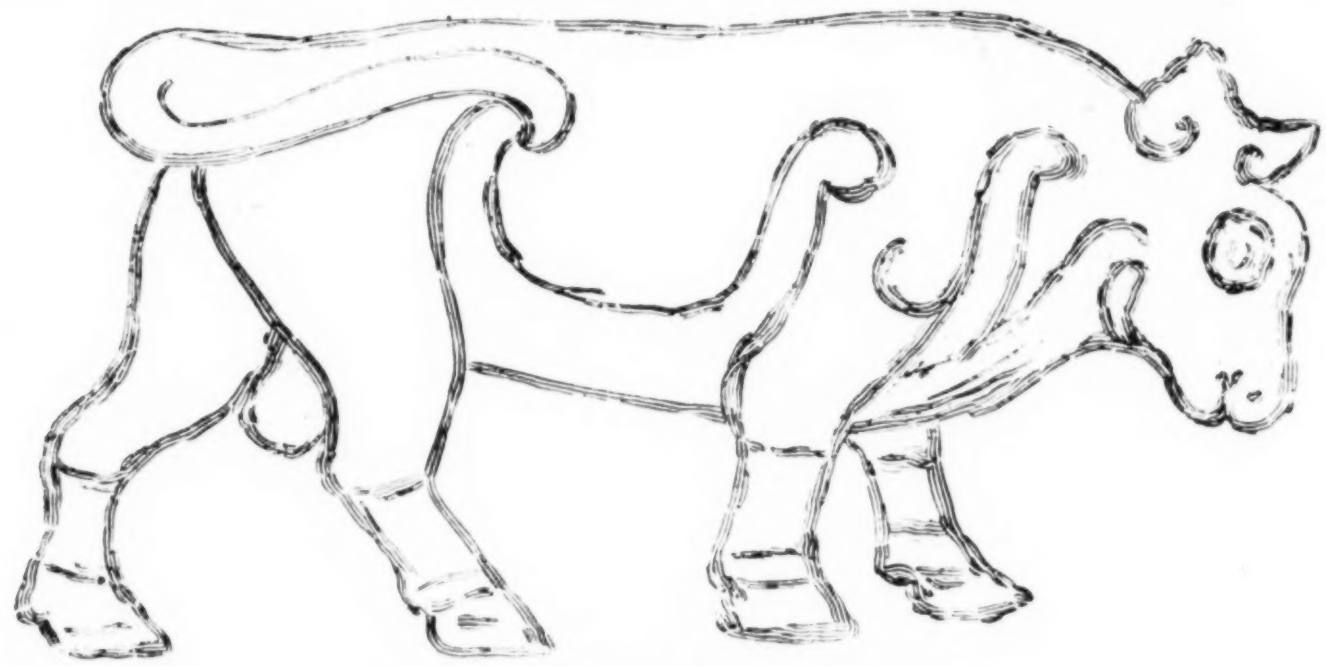
So the legend of the unicorn must be abandoned, with its absurd explanation. An interesting light has just been shed on this question with the discovery by scientists associated with The American Museum of Natural History, New York, in exploring the Mongolian desert, and plateau of Central Asia, in search of the remains of animals that once roamed this, as it is believed to have been, "nursery of the great families of mammals, including man."

The family trees of many of the main groups, so far as they could be traced through fossils, seemed to lead back, in the

POLLED BULLS "HEAGUING OR BUNTING"

Figure 14

Figures of two polled bulls from Miegle, Scotland. The antiquity of these carvings cannot be doubted; they are believed by some to have been made to commemorate victories of the Picts over Scandinavian invaders.



THE BURGHEAD BULL

Figure 15

Sculptured stones at Inverness, Scotland, show bulls that are unmistakably polled and others with horns. Similar distinctions are seen in many other incised stones in the North of Scotland.

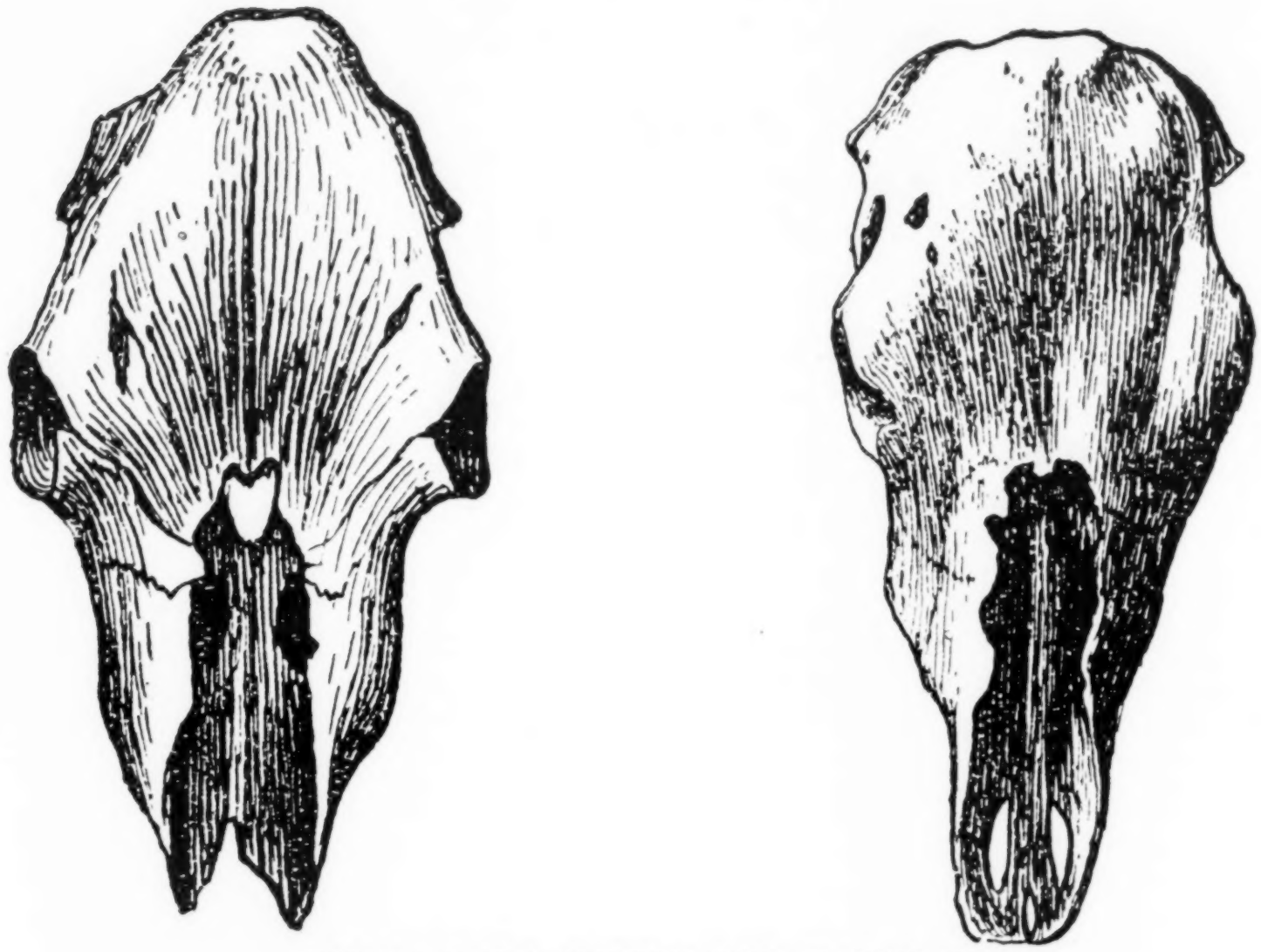
minds of paleontologists, to the plateau of Central Asia. Domestic dogs seem to descend from Asiatic stock, indicating that man and the wild dog first became friends in that part of the world. The cow, sheep and other animals first domesticated are thought to have come from Asiatic environments. This theory has been maintained in spite of the fact that the Mongolian desert, or Gobi region, has hitherto been destitute of fossils. Among many important results, the outstanding one is the proof that the region was rich in life of various kinds at many different ages.

This is not a new chapter, but a new volume in the history of the world. The Gobi desert, which runs from Mongolia into Tibet, is the crown of the world. The results so far obtained are of extreme importance. The principal discovery that has been made is that of the skull and other parts of the primeval rhinoceros (Baluchitherium) whose skull or pate measured four feet three inches in length. The Baluchitherium was between 11 and 12 feet high and about 23 or 24 feet long. It was apparently one of the *hornless* varieties.

Here is where this discovery is of interest to us, for as Dr. Osborne remarks:

The horn is always a compensating organ, found only in animals which have no other means of defense. The Baluchitherium did not need one, apparently. He was defended, first by his size; then possibly by short tusks and a hide of enormous thickness. It was a browsing animal. Its enemies were probably the sabre-toothed tiger and other great carnivores, but it is doubtful whether they could have inflicted damage."

The Baluchitherium was a one-horned ani-



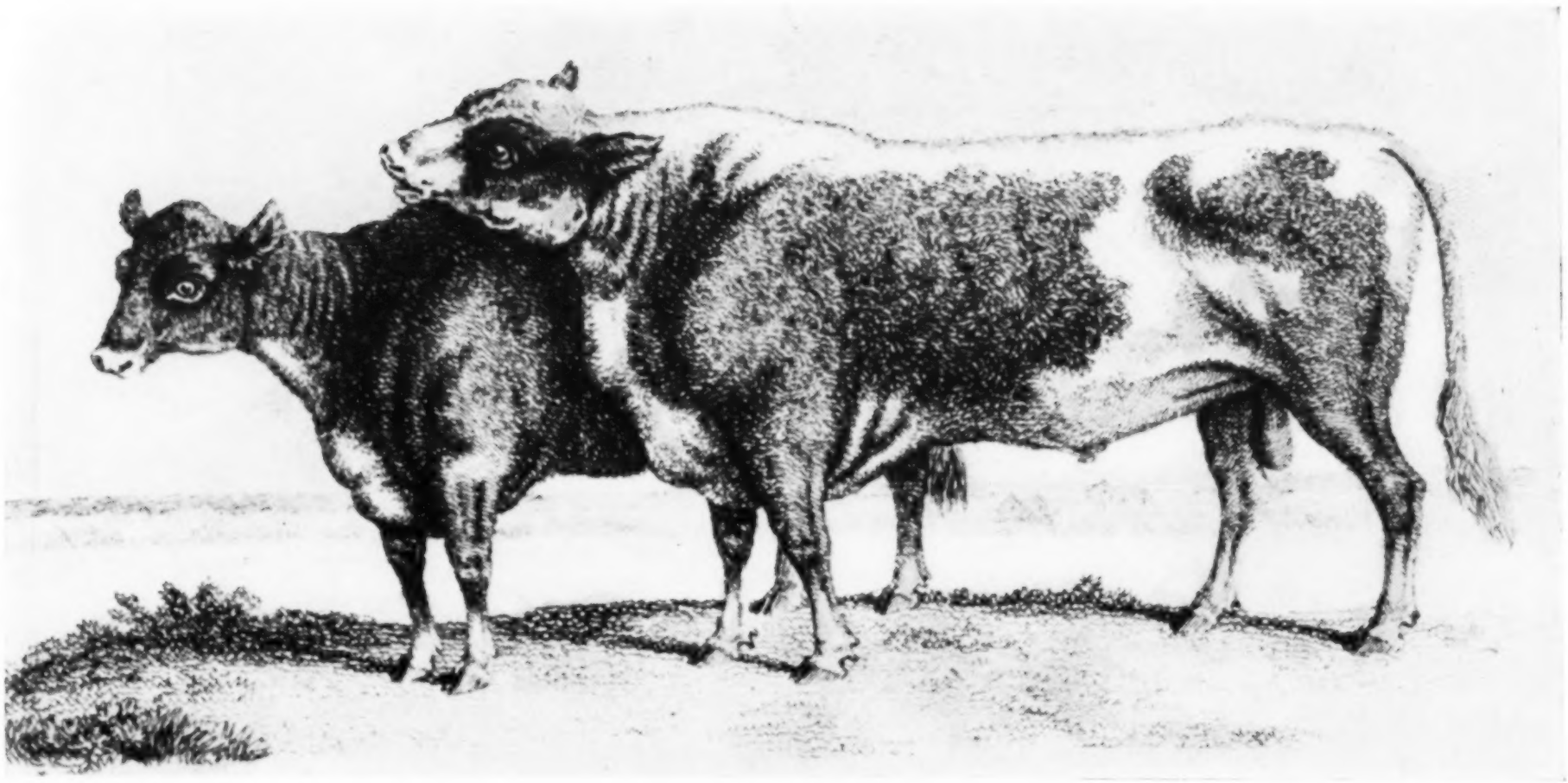
SKULLS OF HORNLESS CATTLE

Figure 16

Skulls of Irish (left) and Dutch hornless cattle. The Irish skull dates from about the ninth century, the Dutch skull was found in association with Scandinavian artifacts in a mound in North Holland. It is believed by Wilson that the polled breeds were introduced into the British Isles and neighboring regions by the Norse invaders of the ninth century. After Wilson.

mal—but not a unicorn! His horn was mesial, in the middle line above the snout. It was entirely epidermal—had no osseous base with the hide, just as the loose "scurs" occasionally found on certain bovines "go with the hide." This gigantic animal we may assume was the contemporary and companion of the hornless bovines that roamed the same plateau; and we shall, therefore, wait expectantly for the discovery of the fossil skulls of the early, bovines of the hornless, primitive type. It was in this region also that we must look for the rise and distribution of those earlier forms of equines that spread east into America and west into Europe. Indeed, it must have been in this wide domain wherein man and horse became acquainted and where man subdued him to his will; as it is from these high places in Asia that we find the first traces of those invading hordes of horsemen that swept down into Egypt and created a new civilization, under the name of the horse riders of the Asiatic plains.

Now, how came these nasal horns of the rhinoceros and the parietal horns of the bovine? Darwin could not account for it, though he instances an alleged case of a cow which became destitute of horns by suppuration, and which had afterward hornless calves—a case which he warns us to be very doubtful about, and which of course, is discarded entirely today. Others have worried about the cause of hornlessness and such like peculiarities, as Goethe. Charles Watertown quotes Norman Moore (*Recreations*, p. 301), on the nudity of the forehead and mandibles of the rook thus: "I cannot account for the nudity in question. He who is clever enough to assign the true cause why the feathers and bristles fall off, will no doubt be able to tell us why there is a bare warty spot on each leg of the horse; why some cows have horns and some have none. He will possibly show us how it came to happen that the woman mentioned by Dr. Charles Leigh had horns on her head which horns she shed and new ones came in their place. Perhaps he will account for the turkey's putting



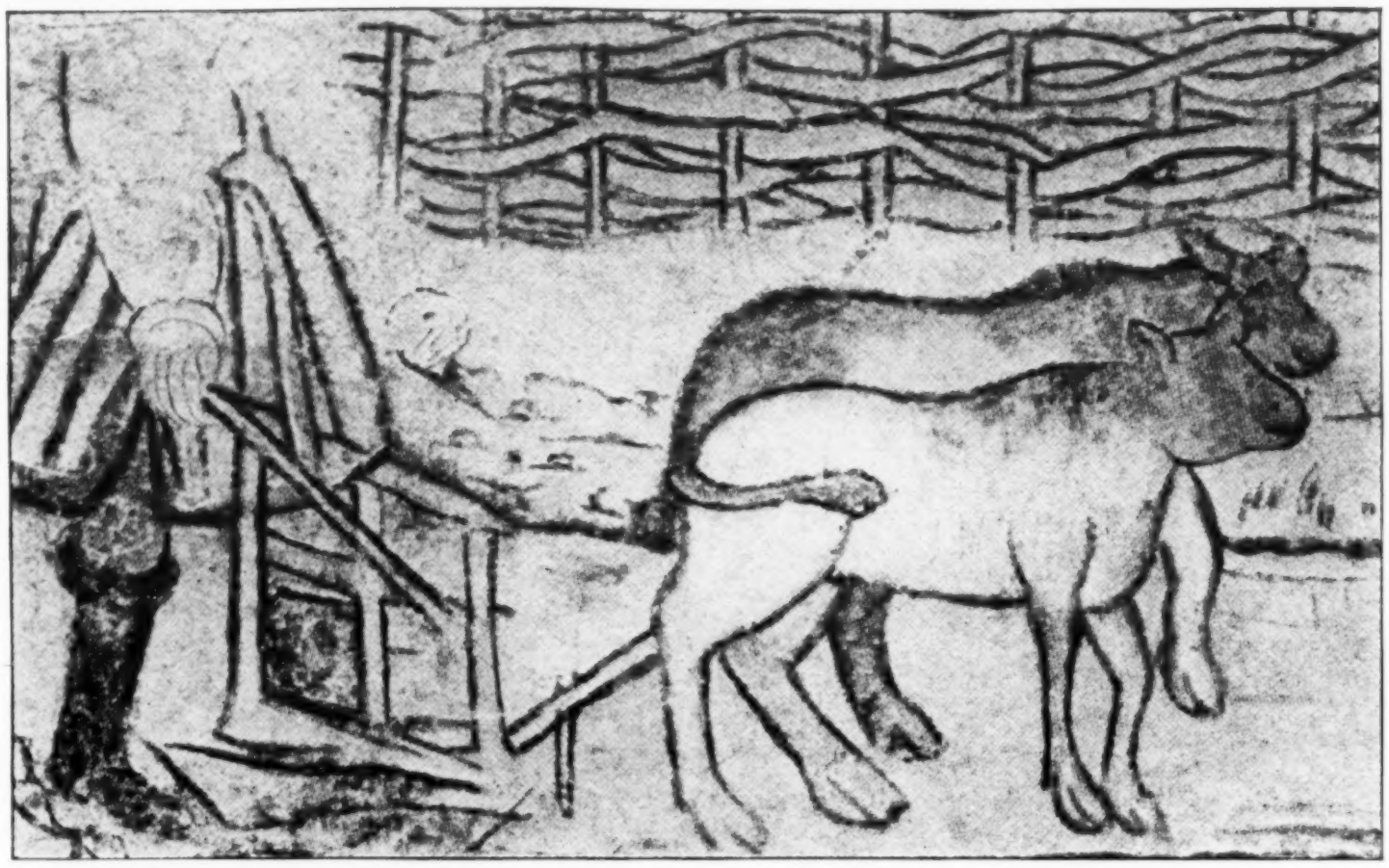
POLLED SUFFOLK DUNS

Figure 17

One of the breeds derived from the ancient polled cattle of the British Isles.

out a long tuft of hair amid the surrounding feathers of the breast," etc.

There should be no difficulty in explaining the origin of horns, that is so far as such explanation furnishes a reasonable means of acceptance of the possible cause. This cause there can be little doubt, is explainable by the theory or process if one would be more positive, of Mutation. This, in the particular case of the extrusion of horns in their various conditions, is a process of the elemental basic germinal constituents, becoming endowed with the force of the inherent growth tendency residing within them, developing independently along some particular path. The explanation thus suggested is as satisfactory as can be presented. Here is the start: it is initiative in the germplasm, no Larmarckian aforethought of "taking thought" whatever. It affirms a tendency of all elemental germinal gametic or genetic units to behave, in the way they do, in the usual assembling or reassembling of the units that have similarly developed. This is what we understand as a real, natural "acquirement" as we would use the term solely. Thus we have the process by means of which "spontaneous," "sudden" and other suggestions of Darwin; and of these "organic changes" which are thought by others to give rise to such a character as the polled condition in our domestic cattle. Mutation, therefore, furnishes the explanatory method or process by means of which the Pliocene hornless animals "acquired" these horns, which happened to furnish weapons of defense and offense, which were an equipment that the human mind explained as the provision so thoughtfully exercised for that purpose! Thus, if as Boyd Dawkins suggests, these horns first appeared in the males—though the theory of mutation would not restrict their appearance to one particular sex, as they would be liable to appear in either (for the suggestion that they were sexual, made for defensive use involves the same confusion of ideas as is apparent in the Lamarckian explanation) — then this change of the elemental units of this-to-be character base, might be going on in several hosts simultaneously. The growth would be robust, like all those "efforts" thus started, and, of course, as we now are in the position of believing (as Mendelism advises us) that every character



HORNLESS OXEN

Figure 18

A painting dating from 1589 showing hornless oxen plowing. After Arenander.

base wherever launched, is capable of reproducing itself, continuously and independently, we might find not only one but two or more individuals being "born" exhibiting the new character. Thence the rest of the evolution would be easy. It seems that the horns, thus *truly* acquired, are, as far as cattle are concerned, recessive according to Mendelian formula and conduct. Hence the remarkable phenomenon occurs of the recessive horned character becoming universal, overcoming the ever *dominant* force of the polled character that we have discovered to inhere and reside in the bovine race even until today—one polled animal being capable, as it has been noticed, of giving rise to thousands of animals so characterized. If then the horned character is recessive and entirely excludes the possibility of the polled being carried on and reproduced, how came it that the polled character has so persistently survived?

This is a nice question. Perhaps the following will find acceptance, as an explanation. We suppose, that, in the development of the horned condition, the horned would breed together. We may assume some process of natural selection here, even that the horned might provide better fighting individuals, and would become, as it were, the fighting front of the great herds, and that gradually these would increase. But we may also imagine that in the rear of the herd there would be present always a polled contingent, direct descendants of the original hornless herds which would carry on and transmit the original character to succeeding generations. Perhaps herds or groups of these, as the natural foes became less aggressive, would separate themselves out from the horned majorities and so local groups of hornless would be possible, representing the original hornless species, for which a distinct name becomes necessary and for which such a name has been provided. For thus we see that there must have originally been such hornless species to which we cannot deny an existence, and, therefore, a name.

Many paleontologists have devoted their attention among other directions to the finding of the remains of the ancient races of domestic animals. Among those we can name are Falconer and Rütimeyer, and others. Boyd

HORNED VERSUS HORNLESS

Figure 19

Battle between a horned and a polled stag, showing the use of the feet in fighting. Polled stags and bulls are easily a match for their horned adversaries; horns seem to be useful chiefly as a protection against carnivorous animals.

Dawkins has pointed out to us the skull of the Italian species *Bos etruscus* (Falconer), which was the first species to furnish him with an instance of the hornless bovine. Falconer also discovered other species in India, similarly characterized, of the *Leptobos* species. He writes:

> In geological history the first appearance of an animal with the distinctive character of the ox species is in the early Pliocene or late Miocene period when we meet with a bald or polled animal to which the name *Bos planifrons* has been given. In subsequent ages animals with horns appear, which keep growing larger in succeeding generations till we meet with gigantic varieties of *Bos Urus* or *primigenius*, a breed which was in existence down to the historic human period.*

The great authority on this question in Europe today is most certainly Professor E. O. Arenander, of Ultuna University, Upsala, Sweden, who has made continuous and searching inquiry into the subject for many years. He has been generous enough to present the writer with all his numerous publications, including the complete work of his study on polled cattle, a much more elaborate work than his original Halle thesis. In a letter dated February 15, 1924, he says:

> It is not at all the *Bos planifrons* that is without horns, but three specimens of the *Leptobos*, that are without horns. Of this *Leptobos* some have horns and some have skulls without horns:
>
> Leptobos Falconeri (Rütim), from Tertiary Pliocene.
> Leptobos Strosi (Rütim.), from Tertiary Pliocene.
> Leptobos Frazeri (Rütim.), from Quaternary Pleiostocene.
> .....Indian.
>
> Of these the two first have the shape of

*Primrose McConnell, B.Sc., in an article on Cattle History in the "Encyclopedia of Agriculture" (Green & Co., London).

the polled head very different from the polls today: it is also perhaps that they are earlier forms. The third, *Leptobos Frazeri* is very like the polled cattle of today and I have described it in my papers (See Table IV). All these *Leptobos* species are described in a work by L. Rütimeyer, namely: Die Rinder der Tertiar Epoch. Zurich, 1877-'78.

As to my *Bos taurus akeratos* (Aren.) you will find it in my papers, Chapter X and that is the scientific name of the species that I have given to the polled cattle in Europe and America today. Before my thesis the naturalists did not regard this form as worthy of special interest; and did not give it a scientific (species) name. But after the appearance of my thesis it has been employed in the scientific literature.

All the domesticated oxen of Europe have the species name *Bos taurus* given by the great Swedish naturalist C. von Linne. But there are more subspecies under it, as the *Bos taurus brachyceros* offspring of a probable wild *Bos brachyceros* (Adamets), and at least *Bos taurus akeratos* (Aren), the domestic offspring of a supposed wild polled species now found in the paleolithic times as you have pointed out (See reference to Dr. Pocock). One older ancestor of this is probably *Leptobos Frazeri akeratos*, as you will find in my papers.

In a pamphlet by Arenander* we find the following statement:

Because of a wrongly interpreted observation we have since the days of Linne and until now considered it reasonable to suppose the polled cattle to originate from the horned cattle and not exactly the opposite, as the author of this paper already stated and tried to prove twenty-three years ago (that would be 1896). Several scientists as Middendorff and Boyd Dawkins, however, have previously demonstrated the absurdity of the old view in this respect. The oldest primitive form of our polled cattle I considered to be *Leptobos Frazeri*, and some other hornless forms of the pleistocene period in India, which have been described by Rütimeyer (1878). If Professor Pocock is right, a sketch from the Madelaine period of the paleolithic age shows that polled cattle had already been domesticated in these times. From the same cave, Bruniquel in France, also originates a piece of sculpture representing a wheat-ear and a horse-tooth and crania originating from hornless cattle of a West-European kind. Besides, pieces two thousand years before Christ have been found in the Swiss pile-dwellings, as well as in the Danish rubbish-heaps and in Ireland's peat-bogs. Polled cattle in northern Europe were already mentioned by some Greek and Roman writers. In Northern Europe polled cattle are at present to be found in England, Scotland, Ireland, Norway, Sweden, Finland and Russia. In earlier times they were found in Egypt 2,150 B.C.; and up to the present day we find polled cattle in the French West Africa that perfectly resemble those in the north of Sweden (Norrland). These facts show both the great spread and the immensely marked immutability of the European polled cattle during all ages, affording, at the same time the best possible proof of the unchangeableness of the natural types of domestic cattle.†

Thus it will be seen that from the evidence now plentifully before us that the first bovine and other ruminant animals were hornless; and that a name characterizing them as such is therefore proper. The term applied by Herodotus to the hornless cattle of Scythia, described as wanting or deprived of horns, was actually aceratos or akeratos, and thus combined with the generic term Bos would be appropriate for the primitive parental or ancestral hornless type; so that the simple designation *Bos akeratos*, would seem to be sufficient. So this name is suggested for the Pliocene species; while *Bos taurus* may still apply inclusively to the Pleistocene species, with other names such as *Bos trocheros and Bos brachyceros*, *Bos urus* or *primigenius* and *Bos longifrons*, and so on, for the various differentiated species, in which horns are present. To the persistent section of the polled branch as defined herein, that has apparently always been associated with the horned, the name *Bos taurus akeratos*, described by Arenander as the descendants of a supposed wild polled race, would apply. Only in our opinion there is no "supposed" about it, but the very reverse.

It is interesting that *Bos akeratos*, has recently come into its own. In

*Den Obenhornade Notboskapstypens Oforanderlighet Under Mer an 4000 XXXX Ar, ett bidgrag Till Fragan om Rasgrupptypernas Konstans. Af E. O. Arenander Upsala 1919. Summary in English.

†See the Author's "Hornless Ruminants," *Am. Nat.* 1887.

George Grant McCurdy's magnificent two-volume work on *Human Origins* the species is given as one of the four recognized species of the European field in the glossary p. xxvi: these four being—"*Bos primigenius,* wild ox, the urus of Caesar's text, collateral ancestor of the large long-horned cattle of western Europe; *Bos taurus akeratos,* hornless ox; *Bos taurus brachyceros,* short-horned domestic ox; *Bos taurus,* wild ox."

Civilization as a Social Struggle

AS struggle in human society is raised from the physical to the psychical plane, a new end or purpose controls those who engage in it, and its whole character is changed. In the really human struggle for existence, the aim is not destruction but supremacy; man looks beyond the immediate present, he seeks not so much to meet his needs as to provide a way by which he and those who work with him may have their needs met regularly in the future.

" . . . Very early in human history the truly human, rational, form of struggle must have begun, but the traces of it among savage races are hardly to be found, and its progress with the passing centuries has been slow enough at best. As it has gradually supplanted the lower animal type of struggle, the foundations of civilization have been laid and the region of reason has begun. The *man* struggles with other men in many diverse lines that he may win supremacy, while he and they alike profit from the new relation. The captive is retained as a slave, and then becomes the servant; in later times tribute is exacted, and the conquered people is left as a source of revenue; at length it is enough that the authority of the conqueror be recognized, and the conquered race is admitted to all the privileges of citizenship. In the first instance, the conquered remain, but their civic life is destroyed; the exaction of tribute cripples the independent existence of the conquered race and brings no lasting benefit to the conqueror; but when at length the conquered race can be fused into the life of the superior race, the foundations of future greatness may be securely laid. The struggle for wealth follows much the same course as the struggle for power. First, destruction of the fortunate to secure his good feeding-grounds; then repeated pillagings, destroying crops, but leaving those who will raise more; then a regular tribute, or an effort to secure this by taxing imports; and, finally free commerce, for at length men recognize that this is the surest way for even the stronger to secure wealth. The new form of struggle deserves the name *social,* because it depends on present social conditions and aims to extend, rather than to destroy them. It is called *rational,* because it keeps in view the future as well as the present, and pursues the lines which will in the end be most sure to make society more human and more reasonable."

(FAIRBANKS, ARTHUR. *Introduction to Sociology, pp.* 278-279.)

The extract illustrates the fallacy of much of our so-called science of sociology, which lacks the necessary background of biological facts and fails to project a "rational" future for mankind. Certainly, it is a false view that identifies civilization with the tendency to predatory and parasitic control of other races, whether as slaves, servants or forced buyers of goods. Arts and attainments of civilization are borrowed, adapted and combined. A synthesis of materials is possible through contacts and conflicts of social groups, but fusing the life of different races is not to be taken for granted.

The theory that "the conquered race can be fused into the life of the superior race" finds little warrant in biology or in history, as laying "the foundations of future greatness." Different races may function in the same economic system, but with tensions and cleavages that weaken the social structure. Hostile nations may be formed by members of the same race, or hostile interests develop in the same nation, as shown in civil wars, but the settlement of such conflicts does not call for the fusion of different and unequal stocks. The capable race that is led to dilute its blood or to become parasitic and sterile, only invites its own destruction when it establishes such "supremacy."

The interest of the race is not kept in view when wealth and power are considered as the essentials, and the

quality of the human material of the future generations is left out of account. Servants may be more profitable than slaves, and customers more profitable than servants, but the "surest way for even the stronger to secure wealth" may lead to extinction rather than to "future greatness." Biology shows us the dangers of parasitism as well as the dangers of hybridism, and the failure of all such experiments in the past history of mankind should teach us something. It is time that these primitive and superficial notions of "greatness" were laid aside.

If sociology is to become a useful science, it must not be developed merely by deductions from false economic assumptions, but must be brought into practical relations with biology and eugenics. Wealth and welfare are not the same, and often come into direct conflict, as in the struggle of rural and urban interests at the present time. The conditions of agricultural life apparently are necessary for developing and maintaining the human abilities and family relations that support civilization. A race that abandons its agricultural life adopts the status of a parasite, dependent on other races. This is the question of our own time, whether we maintain our existence and develop our national ideals as an agricultural people or succumb to urban parasitism and adverse selection.

From the standpoint of eugenics it is plain that the needs of the future are not to be met through the policy of parasitism, by establishing large systems of control of other races. Whether the control be military, political or economic, may make little difference in the end to the races that become parasitic and effete. "The paths of glory lead but to the grave," as the poet says. What shall it profit a race if it gain the whole world, but at the price of those qualities that made the attainment possible?

O. F. Cook.

Soy-bean Acreage in U. S. Now More Than 2,500,000 Acres

ALTHOUGH the soy bean came to this country many decades ago as an unknown immigrant, it only recently has won a recognized place in the cropping system of American farmers. Recent interest in the soy bean and its products together with the increased acreage devoted to it during the past decade indicate, according to W. J. Morse, forage crop specialist of the United States Department of Agriculture, that it is destined to become a crop of considerable economic importance in the United States.

In 1917 less than 500,000 acres were devoted to soy beans for all purposes. In 1924 there were 2,500,000 acres, of which about 1,000,000 acres were grown for hay, about 1,000,000 acres for pasture and silage, and more than 500,000 acres for seed production. About 2,283,000 bushels of seed were produced in 1917, while in 1924 nearly 10,000,000 bushels of seed and 1,360,000 tons of hay were produced.

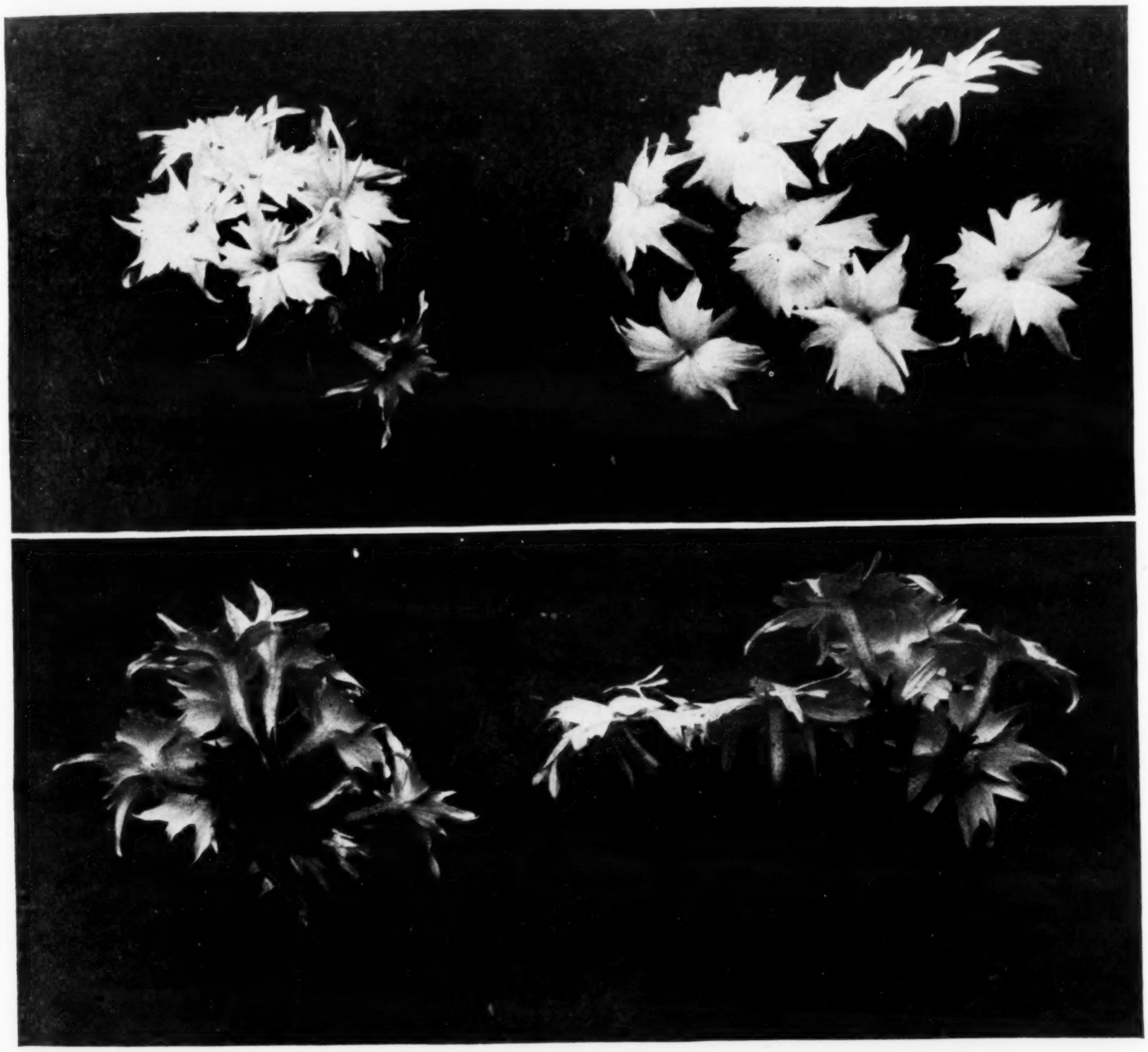
The soy bean can now be grown successfully in any climate suitable to corn or cotton, says Mr. Morse. The department during the past 10 years has developed, through introduction and by breeding methods, varieties which have extended the range of profitable soy-bean culture far beyond what were at first considered its limits. The principal uses of the soy bean are for hay, pasture, silage, grain, oil and oil meal, and human food. With such a wide range of uses the production of the soy bean is no longer localized and its increasing importance is assured.

U. S. Dept. Agriculture.

FASCIATION IN PHLOX DRUMMONDII

The Origin and Nature of Fasciation in Phlox

JAMES P. KELLY
*Pennsylvania State College**



FLOWERS OF FASCIATED PLANTS

Figure 20

Above are shown two flower clusters of phlox—fasciated on the left and normal on the right for comparison. Both clusters contain the same number of flowers. Below are side views of the same two types. The flowers of the fasciated plant are more closely clustered together, but otherwise the blossoms are normal.

FASCIATION, as it has appeared in the writer's cultures of Drummond's phlox, affects the upper part of the shoot causing branch stems in the neighborhood of the inflorescence to grow together more or less. It does

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UNUSUAL EFFECT OF FASCIATION

Figure 21

Right: An unusual case in which a branch was broken because it was free below but coherent due to fasciation above.

Left: Normal plant shown for comparison.

not ordinarily affect individual flowers but the groups of flowers often are more compact because of the concrescence of the stems that bear them. (See Figures 20, 21, 22). Sometimes, however, the flower itself may be abnormally borne—deflexed. Fasciation is an exceedingly variable characteristic—among the sibs of a family and among the branches of the same individual. A plant classed as fasciated may exhibit marked fasciation in its early branches and later give a shoot that is normal-looking.

The character of fasciation was noted for the first time in 1922. In a family whose parent had white fimbriate flowers and presumably normal stems (since there was an absence of any reference to abnormality in the stem in the rec-

FASCIATION CONFINED TO UPPER PART OF STEM

Figure 22

Approximately whole plants (normal-stemmed at left and right pair fasciated) to show restriction of the abnormality to the upper portion of the shoot.

ords) the new character was seen in seven out of the total of 36 sibs. This is an approximation to a 3:1 ratio and indicates that the parent inbred in 1920 to give these 36 sibs was heterozygous for the character pair normal and fasciated stems. This parent arose undoubtedly from the fusion of a normal gamete and one holding the (new?) gene for fasciation. It is possible, then, that about 1919 (or preceding this, indefinitely) a mutation arose in one line of phloxes which came to the surface in 1922 in the form of the fasciated stem. In one other family in the same year four plants in a group of 89 were fasciated. The second family was not related to the first—at least not in recent years—since it was descended from two varieties of European origin grown in the writer's cultures for the first time in 1920. The pedigree of the family first described as showing fasciation in seven of its membership goes back to the first period of the phlox culture, i. e., 1913-1914. The present experiments deal only with the fasciation that arose in the first mentioned pedigree.

Since the cropping out of fasciation

in 1922 many plants showing this trait have been selfed and the progeny practically all repeated the fasciation to some degree. Two of ninety-four such progeny exhibited no obvious fasciation which is not surprising in a character so fluctuating as fasciation.

The First Generation After Crossing

Many crossings were made in which the character differences fasciated as contrasted with normal stems were watched by the writer. In all 27 such hybridizations were made giving a total of 124 F_1 progeny. Invariably the fasciated trait failed to appear among these F_1 plants—the normal-stemmed condition proved dominant.

The author in his studies of the transmission of the single and double flowered condition in these phloxes has encountered a variable dominance depending possibly on the particular genes for "single" that the "double" genes are constrained to associate with, or on other items in the genotypic complex that vary with different crossings. He therefore presents in Table 1 details relating to the parents used in the crossings to show that diverse factorial backgrounds were offered the fasciation gene or genes. It should be noted that in all the F_1 plants fasciation remains completely latent.

The Second Generation After Crossing

Twenty-six of the F_1 plants were self-pollinated and gave rise to a second hybrid generation totalling 499 individuals. Of these, 390 were classed as normal-stemmed and 109 as fasciated (see Table II). Such a ratio suggests that a simple Mendelian difference is involved.

Theory would lead us to expect in an F_2 group of 499 plants 374.25 of the dominant type to 124.75 of the recessive with an allowance of a probable error of $\pm$ 6.524. Our experimental figure deviates from the calculated by somewhat more than twice this experimental leeway permitted us by the statisticians. The deviation is probably significant. A bias against the fasciated groups is to be expected because of the fluctuating nature of this character. Some genetically fasciated plants, it is suspected, helped to swell the numbers in the columns headed non-fasciated or normal.

Discussion

Fasciation is a wide-spread anomaly of the plant world and the general aspects of the subject were thoroughly presented by O. E. White in 1916.[5] He found records of fasciation in 102 of the 290 families into which Engler divides the vascular plants. Yet, in only two cases, i, e., *Pisum sativum* and *Zea mays*, were data available in the published literature that permitted a mendelian analysis of how fasciation was inherited. In Mendel's own list of

TABLE I

Key number of cross	Parental differentiating characters	F_1 Generation: Number	F_1 Generation: Stem Character
1	Non-fasciation and fasciation	11	Non-fasciated
2	Non-fasciation doubleness and fasciation singleness	2	" "
3	Non-fasc. dusky color and fasc. white	3	" "
4	Non-fasc. entire petals and fasc. cuspidate	10	" "
5	Fasciated white and non-fasc. cream	12	" "
6	Non-fasc. cream entire and fasc. white cuspidate	26	" "
7	Fasciation normal style and non-fasc. astylis	2	" "
8	Fasc. normal style cuspidate and non-fasc. astylis entire	4	" "
9	Non-fasc. carmine entire and fasc. white cuspidate	13	" "
10	Non-fasc. double entire scarlet and fasc. single cuspidate white	25	" "
11	Non-fasc. funnel pink entire and fasc. salver white cuspidate	12	" "
12	Non-fasc rose entire and fasc. white fimbriate	3	" "
13	Non-fasc. dwarf scarlet entire and fasc. tall white fimbriate	1	" "

TABLE II

The F_2 Parent: Crossing in table 1 that gave rise to it.	The F_2 groups: non-fasciated or normal.	Fasciated	Totals
Type 4	28	6	34
Type 4	9	7	16
Type 4	10	3	13
Type 4	4	2	6
Type 5	7	4	11
Type 5	23	6	29
Type 5	31	7	38
Type 5	4	1	5
Type 5	10	2	12
Type 5	4	0	4
Type 5	5	1	6
Type 5	7	4	11
Type 6	11	2	13
Type 6	15	3	18
Type 6	41	10	51
Type 6	5	2	7
Type 6	8	4	12
Type 10	0	2	2
Type 10	8	1	9
Type 10	13	4	17
Type 10	17	4	21
Type 10	5	3	8
Type 12	31	11	42
Type 12	63	11	74
Type 12	26	8	34
Type 13	5	1	6
Totals	390	109	499

character differences in peas fasciated and non-fasciated stems made one of the seven classical pairs. Here, fasciation proved to be a simple recessive. In the case of maize, some of the reports indicated that fasciation was a dominant character and others seemed to show that the reverse was the truth, i. e., that fasciation was recessive. To these two cases White added his own data on tobacco, in which fasciation proved intermediate in the F_1 generation after crossing with normals and in which in the F_2 generation a simple 1:2:1 ratio was observed.

Brief reference to some of the more recent work may be of interest. In 1918 Stout[3] reported a type of fasciation in chicory as being strongly heritable but with variability in the expression of the character; and as being intermediate in the F_1 generation. Shull[2] in his extensive cultures of Bursa has had the hereditarily fasciated species *B. viguieri* under observation. He has not yet published on this form but he informs the writer that the fasciation here is a recessive character which segregates out in the F_2 in essentially a monohybrid ratio. Baur[1] in his monograph on *Antirrhinum majus* published in 1924 stated that one of the most frequent mutations in snapdragons is the type with a banded or flattened stem; that this characteristic is exceedingly fluctuating; and that in one of the strains arising from such mutation the character fasciation behaved as a simple recessive. Fruits of certain varieties of tomatoes are said to be fasciated and to represent a fusion of two or more ovaries; such fasciation was found by Warren[4] to be inhibited by a pair of complementary factors.

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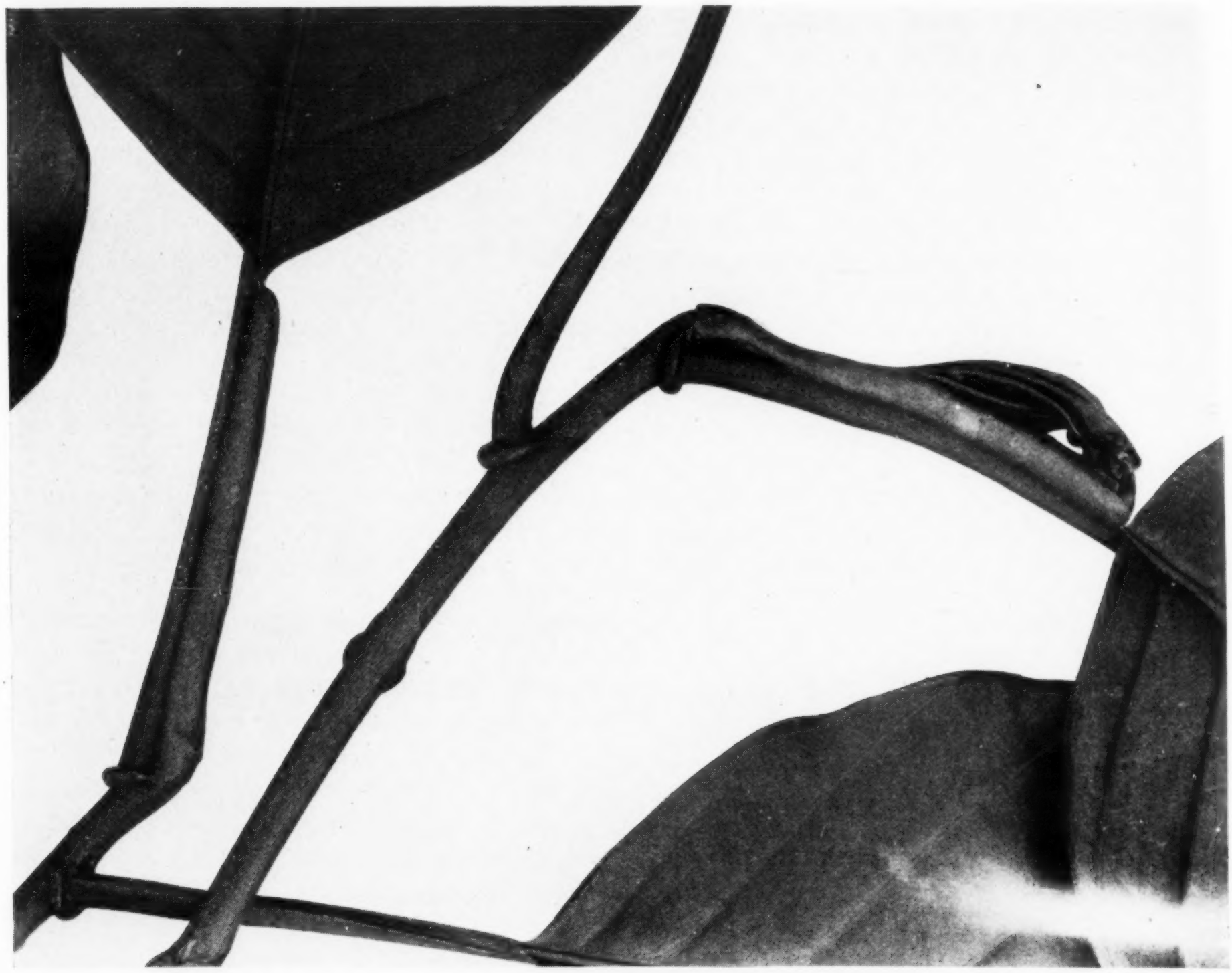
Inheritance of Acquired Immunity in Rabbits

O. HERRMANN (*Centralbl. f. Bakt.*, March 1st, 1926, p. 81) has made experiments on the inheritance of acquired immunity to rabies in rabbits. It was found that the young were often immune, even when born as long as three and a half months after the active immunization of the mother had been completed. Such animals resisted the subdural inoculation of street virus; but the number of young that were immune depended on whether one or both of their parents were immune and perhaps on the number of days elapsing when the mother alone was immune between active immunization and pregnancy. The results are not sufficiently numerous to determine whether the inheritance of acquired immunity followed the Mendelian law, but the author thinks they favor this interpretation.—*Brit. Med. Jour.*, April, 1926.

LEAF BUDS OF THE WORMIA TREE

DAVID FAIRCHILD



PETIOLE LEAF BUDS OF WORMIA

Figure 23

On the right is seen a young leaf stretched out along the petiole of the preceding leaf and unfolding from its bud like a butterfly from its chrysalis. On the left is a still younger leaf-bud forming a part of the petiole of the next youngest leaf on the twig. Photograph by P. H. Dorsett.

ONE sees many surprising plant forms in the tropics, such as flowers three feet across, leaves that hang limp and flaccid being shaken from their buds by the wind before they are even green, or protectively colored a brilliant red; trees with fruits the size of cannon balls hanging from short curved branches rising from the trunk, huge bamboos over a hundred feet tall growing in clumps fifty feet in diameter, which do not flower for forty years and then suddenly flower and die. Among the palms one sees giants which grow eighty feet tall and three feet through before they produce a terminal cluster of white flowers, weighing a ton, and then die to the ground, and others that require ten years to ripen the fruit after the pollenation of the flowers.

In fact anyone accustomed to observe the slow performance of plants at home sees many strange things going on among the plants in the tropics. In company with my old friend Howard

PETIOLE LEAF BUDS OF WORMIA

Figure 24

On the right is shown a young leaf bud—the terminal bud of a branch—forming a part of the petiole of the last leaf on the branch. In its turn this leaf lay as a young bud along the petiole of the next youngest leaf, part of which is shown below it. On the left is shown (above) a young leaf which has just unfolded from its "petiole bud scale." One of the drying halves of the scale is already loosened, and ready to fall away from the petiole. Photograph by P. H. Dorsett.

Dorsett we were strolling in search of seeds through the Perideniya Gardens when our attention was attracted to a specimen of the Ceylon Wormia (*Wormia triquetra, Torrl*) which has the most unusual leaf and flower I think I ever saw, so strange in fact that the cameras were instanly unslung and the accompanying photographs taken by Mr. Dorsett.

The young leaf lies like an outstretched green caterpillar on the petiole of the last preceeding leaf, and as it expands it splits the thin covering or enveloping bud scale from end to end. These split bud scales dry up, turn brown, and drop off. The only mark left by the young leaf-bud on the petiole of the older leaf is a brown streak with slightly raised edges where the scales were attached. In Figure 23 to the left is shown an unopened leaf bud, and on the right a young leaf which has split its green covering scale and is beginning to emerge like a butterfly from its chrysalis. In Figure 24 is shown a half opened young leaf (upper left) and the split covering that once enclosed it beginning to drop off like bud scales from the petiole of the previous leaf. On the right is a young unopened leaf-bud stretched

along an older leaf petiole. I have not the leisure at command to go deeply into this phenomenon and trace the course of development of this character of the Wormia leaf bud. A related species of Wormia from Borneo, *W. burbidgei,* does not have this peculiarity, although the new leaves seem to be surrounded as they develop by the enlarged petioles of the older leaves.

It seems unlikely that this form of leaf-bud serves any special purpose. It simply is a form that has come into existence through variation and is only interesting because it is so unusual. Why it is not a commoner form of bud who shall say? Were it the common form, the usual terminal bud, covered as it is by many scales, would doubtless seem strange and unusually interesting.

The Animal Pigments

LES PIGMENTS DANS L'ORGANISME ANIMAL, *by* J. VERNE, *in Encyclopédie Scientifique.* Gaston Doin & Cie. Paris, 1926. 608 pp.

Professor Verne has brought together in compact form a valuable resumé of the present knowledge of animal pigmentation. The subject is treated technically, but concisely, and is presented in a manner that makes the volume an acceptable reference work. About two hundred pages are devoted to the chemistry of pigments, one hundred each to their morphology and physiology, and another hundred to the distribution and relations of pigments. It is this last part that will probably be of chief interest to most geneticists. Here are discussed such questions as the nature and cause of albinism and melanism, pattern formation, sexual differences, and heredity. The author is somewhat less at home with these aspects of the subject than with some other phases of the work but even here his treatment is fairly adequate and not misleading. He believes that all problems of pigmentation, even the more complex ones having to do with genetics, are essentially problems in chemistry and physical chemistry. Verne doubts if the "discovery of more genes" is likely to advance materially our knowledge of pigmentation, but suggests that a more complete understanding of pigment formation would afford a most promising approach to an understanding of heredity. The volume has a comprehensive table of contents, an adequate index, and a bibliography of over eight hundred titles.

C. H. D.

The Modern Child at Home

MEALTIME is an hour of coaxing and cajoling in the majority of Chicago homes of well-to-do persons where mothers have children approaching school age, it is revealed in a survey being conducted b Dr. Lydia J. Roberts of the University of Chicago.

Dr. Roberts said only 10 per cent of children in these homes go to their meals without coaxing or eat nourishing foods without being cajoled, bribed or threatened. In one case Dr. Roberts told of a grandmother who had to play the piano, dance and sing before the child would eat. In another case a child's nurse had to make believe the mouthfuls of food were comic characters from the funny strips, all going to a party in the child's stomach.

Often, Dr. Roberts related, the child who refuses to eat merely was "playing the gallery" to receive attention, but in most cases under her observation she believed the cause was a physiological or psychological deficiency, physical subnormalcy or poor child management.

In rural homes the situation was reversed, Dr. Roberts said, with a majority of the children going to their meals with a hearty appetite.—*By the Associated Press.*

A LOW TEMPERATURE TYPE OF ALBINISM IN BARLEY

J. L. COLLINS,
University of California

IN January, 1922, a single albino plant of barley was found among volunteer plants in an old barley field. The plant was quite large, had a number of leaves and appeared healthy and vigorous. It presented such a contrast to the usual albino types (which die in the seedling stage as soon as the food stored in the seed is exhausted), that it was dug up and taken to the greenhouse for further observation.

In the greenhouse this plant developed some chlorophyll in its white leaves and produced new leaves having chlorophyll. It reached maturity as a normal plant and produced a number of well-filled six-row heads.

The progeny from this plant grown in the garden during the following summer were all typically green, no albino plants appearing. It was, therefore, concluded that the original white plant was the result of some transitory disturbance and not a hereditary type. As a consequence the seeds of these plants were not gathered when the other experimental plots of cereals were harvested. Later in the fall when the plots were being cleaned these plants were pulled and discarded.

In January, 1923, many volunteer albino plants were found growing about the place where the progeny from the original albino plant had been grown in the garden. They evidently had come from seed scattered from the plants grown on the plot. A number of the albinos were transplanted into rows in another part of the garden. Some of these transplanted plants died, but enough lived to furnish seed for further testing.

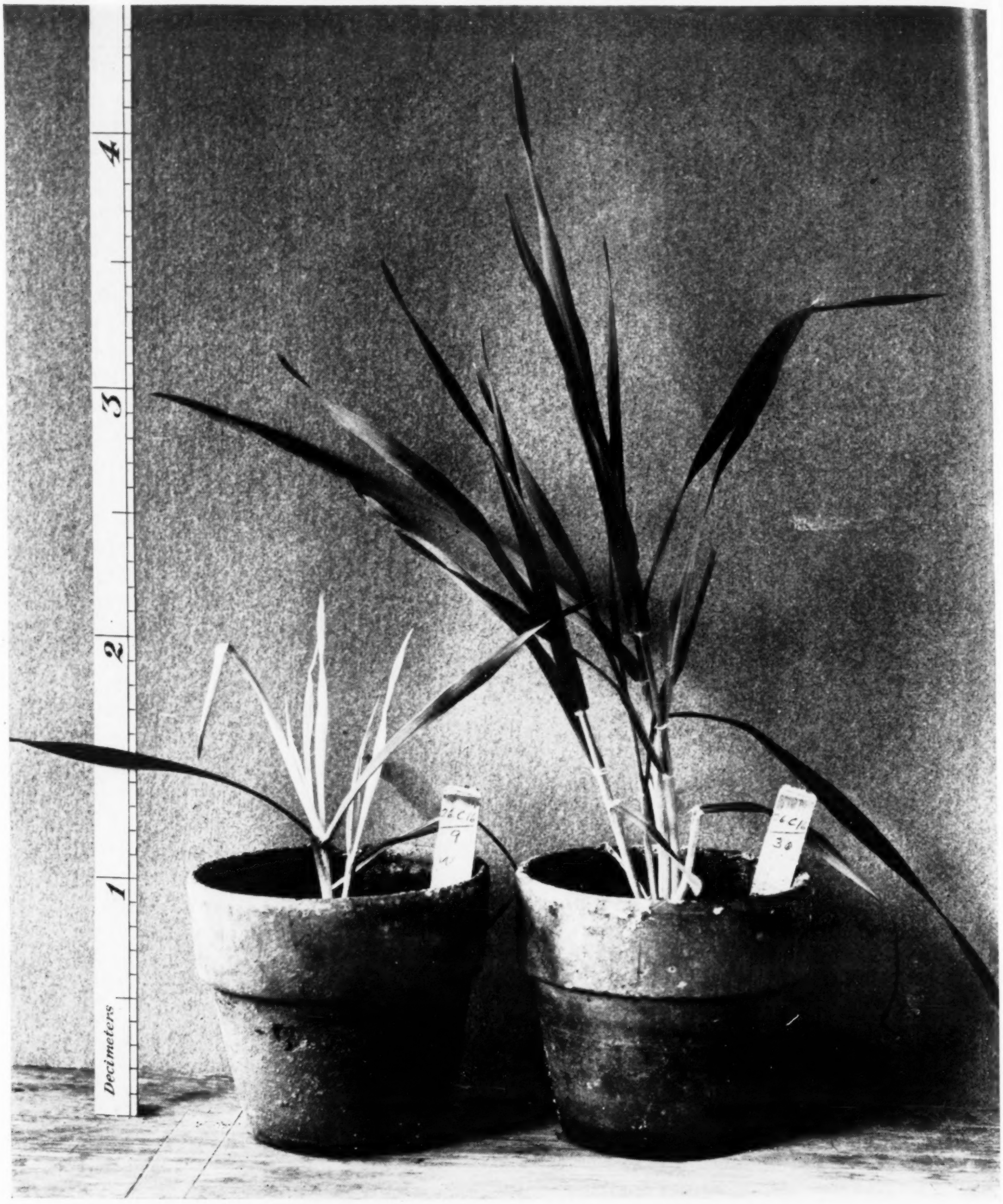
Seeds from a number of these volunteer plants were planted in pots in the greenhouse in the fall and again all the seedlings were green, no albino plants appearing. The need for space in the greenhouse for less hardy plants caused these barley plants to be moved to a cold frame outside of the greenhouse. Shortly afterward it was noticed that these plants were producing new leaves devoid of chlorophyll and that streaks of white were appearing in some of the leaves which were green when in the greenhouse. This process continued until all the plants had some white leaves. As the spring season approached the plants gradually began to develop chlorophyll as did the transplanted garden plants the season before, and eventually all the remaining leaves were green.

This type of behavior led us to believe we were dealing with a hereditary type of albinism but one which could appear only at low temperatures such as occur at Berkeley during December and January (mean temperature 48.5° F.)

In the following fall (1924) progeny from a number of plants were started in the greenhouse and again the seedlings* were pure green. After the appearance of the second leaf half of each culture was removed to the cold frames, while the other half remained in the greenhouse where the temperature did not go below 65° F. As expected the plants outside became albinos largely through the growth of new leaves lacking chlorophyll, while the ones inside the greenhouse continued to produce chlorophyll normally. Four of the white ones were moved back into the greenhouse and in 12 days showed considerable chlorophyll development and later became entirely green, while the ones outside did not become green until about the middle of March when the temperature was considerably higher than during the preceding three months.

Figure 25 shows two sibs photograph-

*There were two exceptions; they each showed a fine white line in the first leaf, the second leaf in both cases was entirely green.



LOW TEMPERATURE ALBINO BARLEY

Figure 25

These two plants are sibs. Both started in the greenhouse in November and both were normal green in appearance at the end of the second leaf stage. The plant on the left was then placed outside of the greenhouse. The plant on the right remained in the greenhouse. (Photographed in February.)

ed in February. The one on the left was moved to the cold frame after the second leaf had appeared. The plant on the right remained in the greenhouse. These matured in the summer of 1926. The progeny of each was grown in December and both consisted of uniformly albino plants, indicating no

genetic difference in the two parent plants.

The failure to produce chlorophyll seems to be confined to the early stages of the plant growth. If plants were able to live until they had produced seven or eight leaves, and most of them do, they were able to go on to maturity for these latter leaves are usually nearly pure green. It is also probable that by the time this number of leaves has been produced the season has advanced until the temperature is high enough to permit chlorophyll production. The following account of the appearance of the successive leaves of one transplanted plant growing in the garden is typical of the plants when grown outside. First leaf green; second leaf white; third leaf white with tinge of green or sheath; fourth leaf white with tinge of green on ligule and sheath; fifth leaf similar to fourth; sixth leaf had three parallel green streaks comprising about one-third of the leaf area; seventh leaf green with one fine white stripe; eighth leaf pure green.

It was demonstrated that this was a hereditary type of albinism which is dependent upon a particular environmental condition, low temperature, for its expression, and that it differs from the more common type of albinism in seedling plants by not being lethal.

Crosses With Normal

In order to study the inheritance of this albino type, plants of this strain were crossed with a two-row barley strain which was normal in its chlorophyll production. Some of the F_1 plants from this cross were grown in the greenhouse during the summer without being subjected to cold. A number of F_2 seeds were thus obtained for winter planting.

Late in November (1926) cultures of the normal and albino parent strains, F_1 and F_2 hybrids were planted in pots in the greenhouse. All plants had a green first leaf*. The cultures were then all moved to cold frames on the outside.

The normal parent strain and the plants of the F_1 culture all remained green. All plants of the albino strain turned white, while the F_2 cultures produced both kinds of plants in the approximate ratio of three green to one albino. The distribution of the F_2 plants is shown in Table I. Each F_2 culture contains the progeny from a different F_1 plant. In all cases the deviation from a 3:1 distribution is less than four times the probable error.

The F_2 segregation from the cross 6 row albino $\times$ 2 row non-albino shows independent distribution of the members of the two gene pairs which indicates that this gene for albino seedlings is not in the same linkage group as the gene for row number. No other linkage tests were made.

The possibility that the intensity of the light may have an influence on the chlorophyll production in these plants has also been investigated. Although it would not seem probable that there could exist sufficient difference in intensity to cause the differences noted in the greenhouse and outdoor cultures.

Seeds from the albino strain were planted in flats and placed in the cold frame. Some were left exposed to normal daylight, another lot placed under a mosquito bar covering, while a third lot was placed under a glass cage the glass of which had been whitewashed to reduce the light intensity.

The first leaf of the plants in all lots was at first a normal green, but as their leaves continued to grow it began to show a deficiency of chlorophyll so that when the second leaf appeared the first one contained only about one-half the normal amount of chlorophyll. The lot of plants under the glass cage appeared to lose chlorophyll a little more rapidly than those exposed to normal light. These results indicate that light reduction would tend to hasten rather than prevent the loss of chlorophyll.

*Two plants showed a white stripe on the first leaf. One was the progeny of a parent plant with a white stripe in its first leaf. See preceding footnote.

Other Cases of Similar Character

Nilsson-Ehle and Hallquist have studied the inheritance of a number of different mutant types of albinism in barley, but the albino described here does not seem to belong to any of their types, although in some of its characters it is similar to several of the types described by Hallquist. He describes one form which is yellow at low temperatures, and at room temperature normal green color is produced, but this type dies after becoming yellow. His lutescens type is green at first, later changing to yellow. If placed in condition of reduced light these plants do not become yellow but remain green. Light intensity appears to play the major rôle in causing the loss of chlorophyll in this type, while the new type reported here recovers the ability to produce chlorophyll without a change in the light conditions, or if any light change occurs it becomes more intense as spring approaches. No evidence has yet been secured concerning the chemical or cytological differences between the green and albino plants.

We have presented an interesting situation when a single gene located in one of seven pairs of chromosomes controls the action of a substance, possibly an enzyme, which is concerned with the production of a material so vital as chlorophyll.

Characters somewhat similar in operation but which do not affect vital functions have been reported in both plants and insects. Baur found a primrose *Primula sinensis rubra* which produced red flowers at 15-20° C but at 30-35° C produced white flowers. High temperature in this case causing the abnormal character to appear.

In *Drosophila melanogaster* there is known a dominant gene for abnormal development of the abdomen but it operates only when the flies are reared on more than normally moist food. Another case is that of supernumery legs which appear only at low temperatures.

Summary

A new albino type of barley is reported which appears only when the plants are grown at temperatures below 45° F.

When plants of the albino type are grown at temperatures above 65° F. they develop chlorophyll normally.

A single recessive gene produces this albino type. When crossed with normal strains a 3 green to 1 albino ratio is obtained.

Limited change in light intensity does not seem to have any marked effects.

TABLE 1—Segregation of F_2 seedlings from the cross albino x green

Culture No.	*Green*	*Albino*	*Total*
27.11	19	3	22
27.12	21	8	29
27.13	6	2	8
27.14	6	5	11
27.15	35	8	43
Observed total	87	21	108
Calculated	81	27	108
Difference		6 ± 2.88	

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